STUDY OF INJURY PATTERN IN ROAD TRAFFIC ACCIDENTS INVOLVING TWO WHEELERS

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BONAFIDE CERTIFICATE

This is to certify that the work embodied in this dissertation entitled **"STUDY OF INJURY PATTERN IN ROAD TRAFFIC ACCIDENTS INVOLVING TWO WHEELERS"** has been carried out by **Dr. M. Seethalakshmi, M.B.B.S., DPH.,** a Post Graduate student under my supervision and guidance for his study leading to Branch XIV M.D. Degree in Forensic Medicine during the period of June 2009 to May 2012.

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DECLARATION

I, Dr. M. Seethalakshmi, M.B.B.S., DPH., solemnly declare that this dissertation titled **"STUDY OF INJURY PATTERN IN ROAD TRAFFIC ACCIDENTS INVOLVING TWO WHEELERS"** is the bonafide work done by me under the expert guidance and supervision of **Capt. Dr B. Santhakumar M.Sc., MD., DipNB(FM), P.G.D.M.L.E.**, Director and Professor, Institute of Forensic Medicine, Madras Medical College, Chennai – 3. This dissertation is submitted to The Tamil Nadu Dr. M.G.R Medical University towards partial fulfillment of requirement for the award of M.D., Degree (Branch XIV) in Forensic Medicine.

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CONTENTS

ABBREVIATIONS

F.R. - Frontal Bone Right

F.L.- Frontal Bone Left

T (Head) - Temporal Bone

P – Parietal Bone

Oc – Occipital Bone

Mn – Mandible

Hum – Humerus

Sh – Shoulder

A – Arm

Elb – Elbow

H – Hand

FA – Forearm

W – Wrist

W.R. – Wrist Right

W.L. – Wrist Left

AF – Anterior Cranial Fossa

MF- Middle Cranial Fossa

TA – Thoraco Abdomen

T (Lower Limb) – Thigh

Kn – Knee

Per – Perinium

CR – Craniotomy

ICH – Intra Cerebral Haemorrhage

IVH – Intra Ventricular Haemorrhage

TR – Tracheostomy

EOHI – Effects of head injury, HI – Head Injury

SHMI – Shock and Haemorrhage due to multiple injuries

EOLLI – Effects of lower limb injuries

EOCSI – Effects of cranio spinal injuries

SHHI – Shock and Haemorrhage due to head injuries

R – Rider

P – Pilion Rider

PPB – Persons Per Bike

MOA – Manner of Accident

TOA – Time of Accident

Hel – Helmet

Sur – Survival Period

Ab – Abrasion

Con – Contusion

Su – Sutured Wound

Fract – Fracture

Menin – Meningeal Haemorrhage

Cere Inj – Cerebral Injuries

Surg – Surgery

Visc dams – Visceral Damage

F bike – Frontal impact by bike

F Car – Frontal impact by car

SF – Self Fall

F van – Frontal impact by van

R car – Rear impact by car

Lor – Lorry

R Lor – Rear impact by lorr

D – Days

H – Hours

RT – Road Traffic Accidents

RTI – Road Traffic Injuries

ISS – Injury Severity Score

INTRODUCTION

India experienced very rapid population growth from 48 million to 1.2 billion in a span of five decades. The population in this country is currently growing at a rate of 1.4% per year far surpassing China's rate of 0.7%. In India rapid urbanization, industrialization, population explosion and migration of people in past two decades results in enormous growth in the field of road transportation. This resulted in increasing amount of the road traffic leading to increased risk for occurrence of road traffic accidents. Evidence from developed and especially developing countries indicates that road traffic accidents are on the rise and are found to be fifth among important causes of mortality globally.

Nearly 1.3 Million people die every year globally due to Road Traffic Accidents (RTA). World Health Organisation in its report projected that fatalities due to RTA is expected to rise by 1.9 million in 2020. In India, Road Traffic Injuries will be the third leading cause of death by 2020. With the increase in the use of two wheelers and cars, congestion and environmental pollution, this mortality rate will continue to rise.

Among the various transportation modes, motorcycles are the most affordable and common forms of motorized transport in many parts of the world. Studies suggest that over 60% of the country's motor vehicles are two-wheelers. People prefer motorized two wheelers for various reasons with travelers opting for a powered two wheeler, as a cost efficient alternative to expensive and less frequent public transport systems , their fuel efficiency , convenience for short distance travel with one or two persons, especially at the peak hours [1], as a means of reducing or

avoiding the effects of congestion etc. Lane splitting permits the motor vehicles to move through the space between the vehicles in the stationary or slow traffic.[2]

However alarming increase of two wheeler accidents due to the smaller size of the vehicle, its inherent instability, unenclosed nature of the vehicle, paves way for serious concern today for India and the world at large. Motorcyclists experience a 35 times greater death rate than the occupants of cars [3.] The latest data released by the Govt of India, Ministry of Home Affairs has revealed that 21% of the road death victims in 2009 in the country were riding two-wheelers. Due to enormous increase in two wheeler collisions, the frequency of doing autopsy on road traffic accident cases by forensic pathologist increases many fold. Autopsy on victims of motor vehicle accidents helps to determine the time of accident, period of survival, manner of accident, rider or passenger, consistency of injury patterns with road traffic accident history, collection of trace evidence to identify the site of accident etc.

Factors predisposing Road Traffic Injuries are classified into Agent, Human and Environmental. Analysis of this Epidemiological Triad is crucial to develop and implement mechanisms for control and prevention of fatal injuries.

Inspite of WHO warning, regarding the RTA fatality by the year 2020, there is limited information on the injury patterns, distribution, and outcomes of the RTA victims of motor cycles in this region. Lack of systematic data generation mechanisms both at the national and state level leads to limitation in designing appropriate intervention strategies to deal with the problem in the

country. Hence it is now crucial for conducting studies on two wheeler accidents in this era of increasing incidence of RTA deaths.

Considering the preciousness of human lives, this study has been undertaken to analyze the pattern of injuries in Road Traffic Accidents Involving Two Wheelers. As a Forensic Medicine Post graduate I am proud to conduct this study to create awareness among the law enforcing authorities, transport authorities and public regarding two wheeler fatalities. A sincere attempt has been made in this study to analyze the distribution of the pattern of injuries sustained by two wheeler travelers, so that appropriate interventional strategies can be evolved at various levels and by different agencies.

AIMS AND OBJECTIVES

- To study and analyze the pattern of injuries in case of victims of two wheeler accidents.
- To study the influence of various physical factors in vehicular accidents involving two wheelers.
- To study the survival period of victims of two wheeler accidents.
- To assess the effectiveness of protection offered by wearing helmet.
- To compare the results obtained with similar studies.

REVIEW OF LITERATURE

History of occurrence of Road Traffic Accidents goes before the invention of motorized vehicle. With the invention of automobiles, the number of road traffic accidents grew exponentially. The first recorded case of road traffic injury was on 30 May 1896 by the cyclist in New York City U.S.A[4]. Modernization made the vehicle a basic need for transportation for every human being. This results in rapid expansion of road traffic accidents in all developing countries. Road traffic accidents constitute a major epidemic among the non-communicable diseases in the present century.

By and large, motorized two wheelers contribute 71% of all the registered vehicles. The growth in the use of motorized two wheelers substantially in the developing countries is accompanied by an increase in the road traffic fatalities.

Road traffic Accident is defined as an accident which took place on the road between two or more objects, one of which must be any kind of moving vehicle. The British medical journal of 11th MAY 2002 reported that, worldwide, the number of death due to road traffic accidents is higher than death from Malaria. In Asia, motorized two wheelers are often used as a family vehicle. According to the United States National Highway Traffic Safety Administration (NHTSA), in 2006, the fatal crashes rate of car was 13.10 / 100,000 whereas for motorcycles 72.34 / 100,000.[5] According to ATS, the rate of serious injuries for motorcycles per 100 million vehicle kilometres was 16 times higher than cars, and twice than bicycles. Motorcyclists they are 30 times more prone than drivers of other vehicles[6].

In India motorcycles are commonly used for personal travel as it is more convenient, time saving and economical. Motorcyclists are more prone for serious vulnerable road traffic accidents due to inherent instability of two wheeled vehicles[7]. 75% of accidents were found to involve collisions between motorcycle and a passenger vehicle, while the remaining 25% of accidents were single motorcycle accidents. The annual growth rate of motor vehicle registration in India is 10.6 %[8].

Factors responsible for road traffic accidents are classified in to human, vehicle and environmental. Risk factors are divided into factors influencing exposure to risk, crash severity, and post crash outcome of injuries. Human factors include age, sex, rider or pillion rider, reaction time, attitudes, thrill-seeking , risk acceptance, hazard perception, circumstances of journey, personal habits including alcohol consumption, medications and other recreational drugs, driving at a prescribed speed or excessive speed , wearing protective helmets, usage of hand- held mobile cell phones while driving, co-morbid conditions, defective vision, hearing impairment etc. Vehicle factors include type of vehicle, power of vehicle, maximum speed, braking, handling, maintenance etc. Environmental factors include day or night, traffic density and its composition, quality of roads including surface road lay outs, maintenance, defective visibility due to environmental factors. Timely identification of accident site, early initiation of first aid and appropriate treatment influence the outcome of the patient.

Age:

Age is an important factor influencing the occurrence of road traffic accidents involving motor cycle. Road traffic accidents ranks among the three

leading cause of death in the age group 5-44 years. Most often young prefer to ride two wheelers than other vehicle. “Minor driver Major accidents” a well said, saying holds true in the current motorized vehicle traffic world. Incidence of motorcycle accident death is low among children reason being children were taken care by the elders and they are less vehicle users. Two wheeler accident deaths among individual aged above 60 yrs are also low due to less mobility of the people[9]. In a study on injuries in Australia, Japan, Malaysia and Singapore, the highest injury risk was found among motorcyclists with a provisional license, followed by those in their first year of riding.

The crash risks for teenage drivers are greater than those for any other comparable age group, with 16-year-old and 17-year-old drivers being at particular risk. Studies in developed countries indicate that the risks were particularly high during the 12 months after a full license had been issued.

The factors behind the elevated risk include:—

1. Mobility patterns and vehicle characteristics (e.g. the vehicle is often borrowed)
2. Psychological characteristics, such as thrill seeking and over-confidence.
3. Less tolerance of alcohol compared with older people.
4. Excess or inappropriate speed, the most common error among young riders.

Late-night driving is also a predictive factor for serious crashes among young drivers. For 16-year old drivers, the late-night risk is three times the daytime risk. While the nighttime risks are greater for the youngest drivers, it

is among drivers aged 20–44 years, that the ratio of night-time driving risk to daytime risk is four.

Zeng Hao Wong et al. 2009 reported in their study that median age of accident victims was 36 yrs[10]. Riders aged below 40 have 36 times higher risk of death and those aged above 40 years have 20 times higher risk of death when compared to other drivers of same age[6]. Jain A et al, 2009 stated that 77% of his sample belong to age group 18-44 yrs.[11]

According to Michael Fitzharris et al, the mean age was 31.3 yrs[12]. Kortor JN et al in 2010 reported that that the mean age of the victims in the sample was 43.1[13].

Gender:

Road traffic accidents are the most common cause of death in the male population. Males are the earning members of the family more often subjected to work related stress more exposed to the outside environment.

Menon et al 2008 showed marked male preponderance in road accidents victims. The reason of male predominance could probably be due to the tendency of violating the traffic rules and regulations, and possession of fake driving licenses.[14]

H. Markogiannakis et al has reported that, young men constituted the majority of injured motorcyclists among the adult trauma patients of Herakleion University hospital. Zargar M et al in reported that among 8500 patients admitted in trauma care ward, 1332 were motorcyclists, with a male

to female ratio of 15:1.[15] Dischinger PC et al and Dolinak et al stated that males are most common road traffic accident victim.[16,17]

Zeng Hao Wong et al in 2009 reported that the majority were male in their victim samples.[10] Michael Fitzharris et al 2009 reported that 88.1% of the victims of their samples were male and 97.2% were riders and 69.8% were pillion riders. But among the female accident victims only 2.8% were riders and 30% were pillion riders.[12]

Martin JL et al in 2004 reported that the incident rate of male to female is 3.1 for mortality and 1.7 for morbidity. The fatality rate and severe injuries rate is higher for male when compared to females among the survivors[18].

Fatigue:

Factors that predispose a driver to fatigue include drivers aged over 50 years, associated medical conditions such as narcolepsy, riding with sleep deprivation for more than 16 hours of wakefulness before trip, riding motorcycle after poor-quality sleep, irregular shift work periods and successive nights of shift work. Some riders are drowsy in the afternoon, breakdowns of the vehicle, extreme climatic conditions, long main arterial roads, monotonous roads, riding after consuming alcohol, riding under time pressure, riding on an unfamiliar route etc.

Oginni FO et al., 2009 reported in their study that 13.5% accidents of their sample victims were contributed by their fatigue[19]. Valent F et al., 2009 found a decrease in the relative risk of accident was associated with sleeping $\geq$ 11 hours daily and an increase in the relative risk was associated with non-sleepy of $\geq$ 16 hours.[20]

Alcohol:

Alcohol affects driving efficiency enormously so that safe driving is seriously affected. This is due to a drop in the reaction time and the drunken driver will take 15 to 20 % more time to press the brake or change the gear, when required. It impairs the concentration and dulls the power of judgement. It creates increase in false and unjustified confidence. It affects the vision, as the visual acuity gets diminished depending upon blood alcohol concentration. With high alcohol concentration, stronger illumination will be required for distinguishing objects and also affects the peripheral vision.[11]

Oginni FO et al., 2009 reported in their study that in 31.2% of riders, alcohol was implicated[20]. Michael Fitzharris et al 2009 reported in their study that there was no significant difference of alcohol consumption in the distribution of riders (55.6%) and pillion riders (52%) .[12]

Harry Hurt et al., 2011 reported that almost half of the fatal accidents show alcohol involvement[7]. About 85% victims of night time crashes have their blood alcohol levels sufficient to influence them.[21] Cherpitel CJ et al., 2003 reported a clear association between alcohol and injury especially for road traffic injury within six hours of alcohol consumption.[22]

Gururaj G et al. 2004 reported 40% of night time crashes and 22% of subjects were under alcohol influence. 51% of cases were two wheeler occupants' death. Disability and severity higher in alcohol positive subjects[23].

Rider / Pillion rider:

Bikers never care about the race, religion, caste but only think about riding. Young males prefer to ride motorcycles. The pillions are usually

children, females and older ones. Rider's factors determine the road traffic collisions such as attention, reaction time, alcohol consumption, co-morbid conditions like epilepsy, myocardial infarction, vision impairment etc. Dandona R et al concluded that riders of motor cycles have a high risk of motor traffic injuries. Rider error as a single precipitating risk factor in about two thirds of skid and fall are due to excessive speed, over braking etc.

Michael Fitzharris et al., 2009 reported that 66.7% of the victims of their samples were riders. 56.1% of motorised two wheeled vehicles were motor cycle whereas 38.6% were scooters, 5.3% were mopeds with no difference in riders and pillion riders in vehicle type[12]. No difference in the severity of the distribution of the injuries, fatality survival outcome in the riders and pillion riders. The risk of injury differed among the riders and pillion riders except in that the crush injuries of the lower extremities lower for riders than the pillion riders. Female pillions tend to have lower risk of fractures of the lower limbs when compared to the male pillions, since the female sit sideways across the seat whereas the male pillions sit facing forward[24].

Hui Zhao et al 2011, reported that in riders, some characteristic superficial injuries were seen in the palm, chest, abdomen as well as the perineal area, which were not seen in pillion riders[25]. Pillion riders are often involved in collisions between motor cycles and four wheelers [26].

Marital status and Education:

Michael Fitzharris et al in 2009 reported that the distribution of rider/pillion rider is not affected by marital or educational status[12].

Monthly Income:

R Dandona et al., 2006 reported that, 52.4% among their samples were the main source of income earner of their family, 41% of the people included in their study had their per capita monthly household income of Rs 2000 or less, 28.2% had their monthly household income of Rs 2001to Rs 4000, 15.1% had their monthly household income of more than Rs.4000[27].

Helmet:

Nearly 50% of the motorcycle riders in traffic were using safety helmets but only 40% of the accident-involved motorcycle riders were wearing helmets at the time of the accident. Safety helmet use by those accident- involved motorcycle riders was lowest for untrained, uneducated, young motorcycle riders on hot days and short trips. The most fatal injuries to the accident victims were injuries to the chest and head. The safety helmet use is the single critical factor in the prevention and reduction of head trauma; the safety helmet which complies with FMVSS 218 is a significantly effective injury countermeasure. It caused no attenuation of critical traffic sounds, no restriction of pre-crash visual field, and no fatigue or loss of attention. FMVSS 218 provides a high level of protection in traffic accidents, and needs modification only to increase coverage at the back of the head and demonstrate impact protection of the front of full facial coverage helmets, and ensure all adult sizes for traffic use are covered by the standard. Helmeted riders and passengers showed significantly lower head and neck injury for all types of collisions[12].

Zargar M et al in 2006, in their study reported that only 2.7% of helmeted riders had a head injury, compared with 11.2% of riders without a

helmet[28]. Michael Fitzharris et al 2009 reported in their study that non helmet users were 1.9 times risk of acquiring open wounds of the head and five times more prone to sustain intracranial injury. Also in this study, among the 19 pre-hospital deaths 16 were not wearing helmet. Among female pillion riders only one was wearing a helmet[12]. Helmet users had a much lower incidence and severity of head injury than riders who did not wear helmets. Turbans appeared to offer partial protection from head injury[12]

Type of collisions:

Victims involved in collisions with other powered vehicles sustained 36% more fractures and higher Injuries Severity Score, when compared with accidents where no collision occurred with a powered vehicle. Motor cycle Collisions more frequently involve Light motor vehicles.

Peek- Asa concluded that 55.5% of collisions occur between motorcycles and cars or other heavy vehicles and 18% of accidents are due to motorcycle falls. Motorcycle running over a pedestrian/animal (8.8%), Motorcycle Vs Motorcycle (4.9%), Motorcycle Vs Heavy vehicle (5.7%), Motor vehicle Vs Non Motor vehicle (5.4%), Motorcycle Vs Fixed object (1.7%). Death frequencies are higher in collisions with fixed objects and heavy vehicles[29].

R Dandona et al in 2006 reported in their study that about 4.4% of the persons were either a pedestrian or a MTV user during the last one year in the most recent road traffic collision and 83.5% were MTV users[27].

Michael Fitzharris et al in 2009, reported in their study that single vehicle accidents are mostly due to skidding, which is most often by avoidance manoeuvres, loss of control and striking fixed road objects. In multiple vehicle collisions buses and trucks are commonly involved[12]

Peek-Asa C, Kraus JF in 1996, concluded in their study that the main factor in the collision involving multiple vehicles was the difficulty in the drivers part in noticing the proximity of motor cycles since the motor cycle is narrow and approximately deciding the time to act to avoid colliding[29].

Harry Hurt et al, Grease n Gasoline, 2011, reported that approximately three-fourths of motorcycle accidents involved collision with another vehicle, which was most usually a passenger automobile. Approximately one-fourth of these motorcycle accidents were single vehicle accidents involving the motorcycle colliding with the roadway or some fixed object in the environment[7].

Manner of collision:

In Frontal collision, the rider of a vehicle continues to move forward as the vehicle abruptly comes to a stop. This forward motion is arrested as the victim connects with the stationary vehicle. The initial impact point is often the lower extremities, resulting in fracture/dislocation of the ankles, knee or hip dislocations and femoral fractures[3]. In lateral collisions, the victim is accelerated away from the side of the vehicle. Compressive pelvic injuries, pulmonary contusion, intra-abdominal solid organ injuries and diaphragmatic rupture are common[3]. Rear impacts also accelerate the victim as the inertia of the head makes the cervical spine more prone for the injury. Ejection from a vehicle is associated with a significantly greater incidence of fatal injuries[3].

R Dandona, in 2006 have reported in their study 35.2% as broadside collisions, Side collision (16%), Motorcycle falls(18%), Cross collisions(35.2%), Lateral collisions(16%), Rear end collisions (12.6%), Collision with pedestrian (6.6%), Multiple impacts (4.9%), Head on collisions (2.9%), Collision with animals (2.1%), Collision with a fixed object (1.7%). High percentage of severe injuries and deaths was noted in head on collisions[30].

Peek-Asa C, Kraus JF in 1996, in their study compared the riders in left turning motorcycles with other left turning vehicles. Motorcyclists had increased lower extremity and abdominal injuries and lower frequency of head, chest and facial injuries than riders of other crash types. The risk for lower extremity fractures was high among riders in broadside collisions and also in multiple-vehicle collisions than single-vehicle collisions[29].

Speed:

In general, greater the speed at the moment of collision, greater will be the injury severity. Excess Speed" is defined as a vehicle exceeding the relevant speed limit; "inappropriate speed" refers to a vehicle travelling at a speed not suitable for the prevailing road and traffic conditions.

Accident risk increases as the speed increases, particularly at road junctions and while overtaking – as road users underestimate the speed, and overestimate the distance, of an approaching vehicle. The probability of a crash involving an injury is proportional to the square of the speed. The probability of a serious crash is proportional to the cube of the speed. The probability of a fatal crash is related to the fourth power of the speed.

Javouhey E et al, in 2006, reported that on colliding with fixed object or any other motorized vehicles there are a high risk of injuries and death, usually due to excessive speed, correlated to the high level of energy[31]. Peek-Asa C, Kraus JF., 1996 reported in their study that the higher risk of severe injuries and fatalities are due to excessive speed and also when correlated to the high level of energy[29].

License:

Dandona R et al., 2006 reported that 11% motorcycle riders participated in their study had not obtained driving license. 21.4% had obtained license without mandatory driving test [27] .

Rear view mirror:

Dandona R et al., 2006 in their study found out 49% of the motorcycles had no rear view mirror[27].

Environment:

Area, illumination, condition, traffic signs, reaction time, and conspicuity: Season, day / night, types of the road, presence of traffic police, improper lane discipline curves, domestic animal interventions, pedestrian intervention etc influence the accidents. Road illumination is one of the important factors related to collisions. Data from a study carried out in China revealed that illumination is related to fatal accidents and severity of injuries. Unfavorable local conditions allow vehicle collisions to occur more frequently.

Road factors include road width, alignment, gradient, surroundings, lay out, markings, surface quality etc. Weather, Surface condition, natural light, road lighting, signs, speed limit enforcement etc.

Oginni FO et al., 2009 reported that among motorcycle injured Nigerian maxillofacial patients, 17.6% of motorcycle accidents were attributed by bad roads[19].

Time of accidents:

Michael Fitzharris et al 2009, reported that among 59% of two wheeler accidents involving multiple vehicles, 40% occurred in the evening, 21% between midnight and 6 in the morning [12].

De Oliveira NL, de Sousa RM in 2011 reported that 36.5% of collisions occurred between 12pm and 5:59pm; 30% occurred between 6pm and 11:59 pm. Frequency of accidents are same on Fridays(16.9%) and Saturdays(16.6%), lowest on Sundays(10.8%)[32].

Period of survival:

Nearly 50-60% of all road traffic fatalities occurs immediately at the spot or while transferring to a hospital. Nearly 20-30% dies during hospital stay and 5-10% after discharge from the hospital.

Another study among 378 MTV riders and pillions, 1.6% were spot dead, 3.2% died on their way to hospital and 95.2% reached the hospital.[12]

Conspicuity:

Rider conspicuity increased by fluorescent clothing, white or light colored helmets and headlights on during daytime, wearing reflective or

fluorescent clothing reduced the risk of a crash injury by 37%, a white helmet by 24%, and riding with headlights on by 27 %.[33]

De Oliveira NL, de Sousa RM.2011) reported that 86% motor cycle fatalities occurred in urban and 14% in rural areas. In rural areas victims conditions are more severe than in urban areas due to lack of appropriate traffic sign surveillance and high speed. 77.8% motor cycle fatalities occurred in the appropriate illuminated areas, 22% in the inappropriate illuminated areas[21] within just less than 2 seconds.

Hand-Held Mobile Phones:

The frequency of usage of hand-held mobile phones related accidents has increased to unprecedented levels over the past few years. In U.S.A the number of such cellular phones have increased from half a million to over 162 million during the period 1985 to 2004. It pose higher risk due to the following reasons: Longer reaction time, difficulty to maintain appropriate speeds, correct positions in traffic lanes, in judging, accepting safe gaps in traffic. Drivers using cellular phones face four times higher risk of crash than other drivers[34].

INJURY:

A majority of medico legal autopsies in India are carried out on the victims of vehicular accidents. RTA comprise of mostly injuries to the limbs, face, externally; while more commonly head sustained internal injuries. A careful examination of injuries sustained is necessary for the reconstruction of the accident. From the nature of the injuries inferences can be drawn regarding the relative positions of the victim and the vehicle at the time of

accident. Moreover in 'hit and run' cases, the nature of injuries and collection of trace evidence from the decedent will help to connect the suspect vehicle with the crime. It may also be possible to give an opinion as whether the vehicle had run over the victim.

Definition:

An injury is any harm, whatever illegally caused to any person in body, mind , reputation or property (sec. 44, I.P.C.) **.**

The Injury Severity Score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Score (AIS) and is allocated to one of six body regions (Head, Face, Chest, Abdomen, Extremities (including Pelvis). Only the AIS score highest in each body region is used. The most severely 3 injured body regions have their score squared and added together to produce the ISS score[35].

Mechanism of production of Injury:

Due to the impact between the forward moving force and the counter force, energy is transferred to the tissues of the body, which cause change in the state of rest or motion. It is the rate of change of movement either acceleration or deceleration due to trauma cause displacement and deformation and traction strains in the affected tissues. Tissues vary in their resisting capacity in acquiring injuries.

Pattern of injuries in fatal two wheeler accidents:

Dr. S.S. Oberoi et al., 2011 concluded that 31.34% injuries are contributed by fractures, 29.85% by abrasions, 29.10% by lacerations, 9.7% by contusions[36].

Regional distribution of injuries:

Collisions may be head on collisions, rear impacts, side sweeps and roll-overs. Due to the instability of the vehicle, when collision occurs the victim is ejected from the vehicle, he often strikes his head on to ground. Impact with the road surface or against another vehicle results in head injuries, limb injuries, thoracic, abdominal, pelvic, spinal cord, upper and lower extremity injuries.[35]

In case of inter section type of collisions, where the motor cyclist strikes the side of an automobile, he moves forwards striking the fuel tank, while the pelvis lifts from the seat and the head strikes the side of the vehicle close to the roof of the opposite vehicle. So the primary impact injuries like abrasion, contusions and lacerations are most commonly seen in the areas of inner aspects of thighs and perineum. This is possible because of the friction of the thighs and perineum with the fuel tank. Pelvic fractures and perineal lacerations are also very common due to the impact on of the handle bar of his own two wheeler. The next common regions affected by primary impact are upper extremities and shoulder, whereas abdomen, head and neck are less commonly involved regions. Secondary impact injuries are mostly seen in the head and neck, followed by upper extremities and lower extremities whereas, back and abdomen are the least involved.

Fractures occurring in skull of the motorcyclist, can be summarized as follows:

- Fall on the side with side impact to the head causes Basal Skull fracture.
- Fractures especially Hinge type also called Motor Cyclists Fracture[33].
- Head injury and disabling leg and foot injuries are among the fatal injuries that motorcyclists suffer.[7]

Dr. S.S. Oberoi et al .,2011 concluded that 66% fatal injuries are seen in head/ face, 12% in chest, 8% in abdomen. [36]

Head injury:

Head injuries are extremely common among the road traffic accident victims. Cranio-cerebral injuries are the predominant and fatal injuries among the motor cyclists accounting for 80% of deaths. In adults, cranium varies in thickness and varies from place to place. Most common site of fracture is temporo-parietal region. In RTI, force is transmitted to a wider area and when sufficient to exceed the elastic limits of the skull, fractures may commence from the site of impact or from the area remote to the site of impact, or commencing at a distance and run back to the site of impact. A heavy impact on the skull, fracture the vault of the skull running into the base of the skull usually across the floor of the Middle Cranial Fossa, separating the floor into two halves termed hinge fracture also termed as Motor Cyclists fracture.

H Markogiannakis et al reported that Cranio-cerebral injuries are the primary cause of death (73.3%) among the motorcyclist[37].Most deaths due to

head injuries involved temporal bone (76.34%) and occipital bone was involved in less number of cases (9.14%) [36].

Many series of motor cyclists said, 60% had skull fractures and 80% had brain damage. Common injury of the riders of motor cycles is the 'Tail-Gating' where the rider drives into the back of a truck so that they pass underneath, but the head of the rider impacts upon the tail –board.

Complications of Skull Fracture:

These include concussion, compression, contusion and lacerations of brain.

Meningeal Injury:

At the moment of impact, the skull moves relative to dura beneath it, and the dura is stripped from the bone. Any of the three layers of meninges can be torn by the edges of fractured fragments of skull or by the penetrating objects. However, pia matter and arachnoid matter can also be ruptured due to the accumulation of blood underneath. Contents of the skull are the most fragile of the vital organs.

The Acceleration or Deceleration forces with a rotational element cause brain damage. Halbourn postulates that the brain tissue is injured when its constituent particles are pulled so far apart that do not join up again properly when the blow is over. In the brain, this pulling apart is proportional to the shear strains. When the head is rotated by an impact, the layers of brain tissue slide may either slide over each other causing damage to blood vessels resulting in intra-cerebral haemorrhages, contusions or may tear due to shearing and stretching forces causing lacerations. Intracranial haemorrhage

includes haemorrhage occurring within the cranial cavity. Fracture of the skull bones, though is the common cause of intracranial haemorhage, the haemorrhage can occur even without fracture of any of the skull bone fracture.[38]

Intracranial haemorrhage

I. Intra-axial Hemorrhage

Intra-cerebral haemorrhage and inter-ventricular haemorrhage.

II. Extra-axial Haemorrhage

Extradural Hemorrhage, Epidural Hemorrhage, Subdural Hemorrhage and subarachnoid Hemorrhage.

Arvind kumar et al, noted that from his study Subdural haemorrhage 89%, followed by subarachnoid haemorrhage 72% extramural 20.25% [39,40].

Among 79 cases, 34 victims had linear fracture, 14 had basilar fracture, 6 had communited fracture, 3 had depressed fracture, 4 had crush fracture and 18 had no fracture[41]

Upper and lower limb injuries:

B Knight: Legs are injured either by primary impact with another vehicle or fixed road structures or by being trapped into the parts of the vehicle frame. Common injuries are lacerations, friction burns and fractures.

Kortor JN et al., 2010 in a study reported that the lower limb injuries are the common, accounting for about 55.5% of injuries. Fractures constitute

73.4% of lower limb injuries, with closed fractures were commoner than the open fractures. The commonest bone involved was tibial shaft[13].

Aslam M et al., 2008 said that the patients presenting with tibial injury were significantly higher than the bone injuries of other body part. In 26% of patients, fibula was also involved along with tibial fracture. Others were Femur 16%, Radius 9.2%, Humerus 8.3% Radius was the commonest injured bone and in highest proportion among upper limb injuries ($p<0.001$)[42] .

Calil AM et al 2009 concluded that motorcycle users had a significantly higher number of injuries to the upper limbs, lower limbs and pelvis compared to other victims, while there were more head/neck and face injuries in run-over and automobile accidents[43.]

Lateef F reported that among 1,809 motorcyclists studied, 1,056 (58.3%) sustained lower limb injuries, 328(18.1%) had head injuries and 256 (14.2%), sustained facial injuries.[44]

Michael Fitzharris et al 2009 concluded that only 1% of male pillion riders sustained open wounds of the upper extremity as compared to 8% in female pillion riders.[12]

However female pillion riders (7.9%) are at a lower risk of sustaining fractures of the lower extremity than male pillion riders (26%) because females tend to sit sideways across the seat than facing forward.[12]

Lower extremity injuries were diagnosed in 56% of nonfatal injured and in 44% of fatally injured riders. Fractures were the most common lower extremity injury and were diagnosed in 52% and 42% of riders with nonfatal and fatal injuries, respectively. Over a third of all fractures were to the tibia or fibula. Drivers and passengers did not differ in their risk for lower extremity injuries. Multiple-vehicle collisions resulted in a higher risk of lower extremity injuries than did single-vehicle collisions. The highest risk for

lower extremity fractures was observed among riders in broadside collisions in which another vehicle struck the motorcycle. Peek C in 1994 *c*oncluded that lower extremity injuries occurred in 56% of non fatal injuries, 46% in fatally injured riders. Fractures were the most common lower extremity injury occurred in 52% and 42% of riders of fatal and non fatal injuries, one third of fractures were tibia, fibula.[27]

Injury pattern in riders and pillion riders:

Hui Zhao et al. in 2011 found the difference in the distribution between the riders and the pillion riders regarding the superficial injuries. For drivers than passengers, the injuries in the hand and perineum region were comparatively in high fraction.[25] Michael Fitzharris et al 2009 reported in their study that fractures of the head and neck region were higher in female pillion riders(18%) as compared to male pillion riders(6.8%).[12]

Anish Sam George et al., 2010, in their study reported that in riders the most common injuries of upper limbs were seen in wrist and hand and in the lower limbs over tibia and ankle whereas in pillion riders shoulder and wrist in upper limbs and tibia and ankle in lower limbs. [26]

Singh et al 2005 reported pillion riders sustained more fatalities when compared to riders in .[45]

Crush injury legs / Riders / Pillion Riders:

Michael Fitzharris et al 2009) said that pillions have significantly higher risk of crush injuries of the lower extremities than riders. Female pillions have a lower risk of crush injuries than the male pillions.[12]

Trauma in road traffic accidents:

The trauma sustained in transportation accidents can be classified according to the victim involved as trauma sustained by pedestrian, by cyclist/ motor-cyclist, by occupants of a vehicle. Injuries are Primary impact injuries, secondary impact injuries and tertiary injuries. Tertiary injuries arise when the victim's body strikes the ground after the secondary impact.

Trauma sustained by Cyclist / Motorcyclist:

The primary impact will be usually against some part of the motorcycle. Secondary impact and tertiary injuries are more severe. Examination of the motor cycle is also necessary for the reconstruction of the accident. Trace evidence should be collected from the cycle and from the body of the victim.

The incidence of injury and death amongst motorcyclists is far higher than among car drivers particularly in young adults

CORRELATION OF POSTMORTEM FINDINGS WITH ROADSIDE EVIDENCE:

Evaluating injuries sustained in a motor vehicular crash requires the ability to recognize and distinguish between blunt and sharp force trauma. These are the two most common types of injury that occur in all types of motor vehicular crashes.

Police accident investigators are trained to furnish thorough reports, including witness statements. However, eyewitness accounts of a motor vehicle crash, infact any traumatic event involving severe injury or death, are

often unreliable and sometimes conflicting. While such statements must be considered, they cannot indiscriminately be taken as factual. Eyewitness accounts are frequently tainted by emotions, sorrow and feelings of guilt, resulting in distorted, exaggerated and misleading information.

Therefore, correlation of autopsy findings with vehicular and roadside evidence is necessary. To achieve this goal it is advantageous for the investigating officer to attend the autopsy and perhaps for the pathologist to accompany the officer to personally observe the scene and the vehicle or vehicles involved in the crash, even after the fact, after the vehicles have been removed. Only consideration of the injuries in light of roadside evidence will provide the background for proper evaluation of autopsy findings and assist in subsequent testimony.

MATERIALS AND METHODS

Collection of samples: 147 Two wheeler Accident victims were randomly selected from 1063 road traffic accident cases brought to the Institute of Forensic Medicine, Madras Medical College , Chennai-3 for routine medico legal examination.

Study design **:** Prospective study

Period of Study **:** January – 2011 to October – 2011

Inclusion criteria:

Victims of Two Wheeler Motor vehicle accidents

1. Driver/ Pillion rider
2. Hit by Light Motor Vehicle/ Heavy Motor Vehicle / Self Fall.
3. Brought dead directly to the casualty or died in the hospital in spite of treatment.

Exclusion criteria:

1. Victims of motorcycle accidents other than riders and pillion riders
2. Decomposed bodies of motorcycle accident victims.
3. Bodies which are severely mutilated.
4. Unknown bodies with vague history.

Procedure:

Preliminary data were collected from the medico legal documents such as history of the case , Inquest form, First Information Report, Accident Register, Death Report, Clinical data submitted by the investigating officer at the time of medico legal examination. During autopsy, on external examination, nature of injury, site, size, number were measured in all cases done by me . Internal organ injuries were recorded. Cause of death was arrived at based on the findings made out during autopsy. Data collected were entered into excel sheets and statistical analysis was done using SPSS software version 16.

Proforma:

S.No.: PM no: Age: Sex:

Time of Accident: Rider / Pillion Rider:

Manner of Accident:

Survival Period:

Helmet : Yes or No

Injury Pattern

Head / Neck	:	Abrasions, Contusion, Laceration/Sutured wound, Fractures, Cervical Spine Injury, Meningeal Haemorrhages, Cerebral Injury, Craniotomy.
Thoraco Abdomen	:	Abrasions, Contusion, Laceration/Sutured wound, Fractures, Thoraco Visceral damage, Pelvis Fracture
Upper Limb & Lower Limb	:	Abrasions, Contusion, Laceration/Sutured wound, Fractures, Crush Injury.

Cause of Death :

S.No	PM	Age	Sex	TOA	R/P	MOA	Hel	Sur	H. Abr	H.Con	H.Lac/ Sutr	H.fract	Spine	Menin H	Cere Inj	Surg Rx	TA.Abr	TA. Con	TA.Lac/ sutr	TA.fract	TA.Viscdam	U.Abr	U.Con	U.Lac/sutr	U.fract	L.Abr	L.Con	L.Lac/Sutr	L.fract	L.Crush inj	Amp	P.fract	COD
1	6/11	21	M	1.30 AM	PR	Car	No	7H	Fh.R	L	F.R	MF.L																					EOHI
2	8/11	21	M	3:00 AM	R	Wall	yes	1.30M				AF,MF.L					CT.R					Sh,H.R			2 PP	Kn,L,Ft.R		Kn.R					HI
3	17/11	21	M	6:00 PM	R	Car	No	30M	Ch.R	R,L	F.L	P,MF.R							Liv		1.5 Ltr .	FA,W,H .R	FA.R			T.R,L							SHMI
4	29/11	17	M	9.45 PM	PR	Lor	No	1 H	Ch.R	L	Fh.R	F.L,MF,AF.R,L			IC							H.R				I.R							HI
5	63/11	36	M	8:20 PM	R	F. Lor	No	30 H	Fh.R	R	O.R	MF.R,L										Sh.L				Ak.R							EOHI
6	72/11	26	M	5:30 PM	R	F. Bike	yes	45 H		L							CT.R ,L									I.R		Kn.L	BB				EOLLI
7	84/11	45	M	1:30 PM	R	Bus	yes	3 D		R,L		PO.L,AF.		ED/SD			AD.L					H.L				Kn,I.R							EOHI
8	99/11	35	M	3:10 PM	R	F. bus	yes	16 D		L	Fh.L		C3,4									Elb.L				Ft.R							EOCSI
9	107/11	50	M	8:00 PM	R	F. Car	No	1 D	Fh.R	R							CT.L									Th.R			Fem. R			r.L	SHMI
10	108/11	29	M	7:30 PM	R	F. Lor	No	1 H	Fh.R, L			TPO.R,AF .R			Lac							Elb,Sh. R	Elb.R										HI
11	115/11	55	M	8:00 PM	PR	R.car	No	3 D		L		PT.R			Lac	CR										Kn.L,I.							EOHI
12	123/11	42	M	7:00 PM	R	F. bus	yes	8 D	Fh.R			ZY.R										H.L				Kn,Ft. R							EOHI
13	132/11	25	M	2:30 PM	R	SF	No	3 D	Fh.R, L	RL		F,AF,MF. L			Con							FA.L				Kn.L							EOHI
14	149/11	49	M	6:00 PM	R	F. Car	No	56 H		R	PT.R											Sh.R						Ft.L					EOHI
15	159/11	50	M	4:30 AM	R	SF	No	11.30		L	O.L	O.L																					EOHI
16	161/11	21	M	1:00 PM	PR	SF	No	5 D	Ch.L	R		T,MF,AF. R		SD/SA		CR						A,FA.R; W.L	Elb.L		Hum. R							EOHI
17	168/11	25	M	8:10 PM	R	SF	No	6 D		L				SD/SA	IVH	CR																	EOHI
18	207/11	30	M	8:00 PM	R	Lor	yes	9 D	Ch.R	R		F.R		SD/SA												Kn, L,T.R			Fem, BB.R				EOMI
19	233/11	43	M	8:00 AM	R	Bike	No	15 H	P.L	RL		TP,MF.R		SD/SA													T.R	T,I.R					EOHI
20	236/11	22	M	9:00 PM	R	SF	No	7 D	Ch,Fh.L	L	Fh.L	T,MF.L		SD/SA			CT.L									Kn.L							EOHI
21	248/11	43	M	7:30 PM	R	Lor	yes	4 D	Fh,Ch.L	R	P.R					CR				Rb.L									Fem. L				EOMI
22	252/11	55	M	11:00 AM	R	Lor	yes	5 D	P.R	L	1									Rb.L		Elb.R,L							BB.L				EOHI
23	265/11	46	M	10:00 PM	R	Car	yes	6 D	Fh.R			MF.R		SD												T,I.L;Ak,Ft.R							EOHI
24	287/11	54	M	6:45 PM	R	SF	yes	30 D	Fh.R					SD								A,Elb,H .R	Elb.R					I.R	BB.R				EOLLI
25	302/11	23	M	7:45 PM	R	SF	yes	2 D	Fh,Ch.R	L		T.R,L		SD / SA	ICH		CT.R					Elb.L		FA.R		Kn.R			Fem. R				EOHI
26	324/11	36	M	8:40 PM	R	Trctr	No	Spt		L	O.L	TP.RL		SD/SA	ICH		AD.			Rb.R						Kn.R	1		Fem.				HI

27	328/11	57	M	7:15 PM	R	Car	yes	4 D		1				SD								Elb.L											HI
28	330/11	42	M	7:30 PM	R	F. Car	yes	10 D		1		AF.R,L				CR						Sh.R,H.	Elb.R										EOHI
29	344/11	43	M	10:15 PM	R	Auto	No	1 D	Fh.R, L	3	2	AF.R,L				CR						H.R			MCP. R	Kn.R							EOHI
30	350/11	51	M	6:15 PM	R	Car	No	Brt	T.R	1		MF.R		SD /SA								Elb.R				T.R; Ll,Kn.L		Ft,T. R	Fem, T.R	l,hl. R			SHMI
31	364/11	29	M	4:30 PM	R	F. Car	yes	4 D	Ch.R	P,T.L	Ch.R	MF.R,L		SD/SA								A.L				Ft,hl.L							EOHI
32	367/11	27	M	6:00 PM	R	F.Van	No	2 D	O.R, L		1, 2S	T,MF.R,L ;	Lac	ED/SD/ SA								A,Sh,H. L;				Ft.R							EOHI
33	375/11	27	M	4:15 AM	R	SF	No	18 D		1	1			SD								2 Elb,	Elb.R			2 Ak.R							EOHI
34	369/11	29	M	4:30 PM	R	F. Car	No	4D	TP.R	3	1	MF.R		SD			CT.R									2 Kn, 2 L.R							EOHI
35	381/11	38	M	7.45 PM	R	SF	No	11 D	TP.R					SD SA		TR						2 Elb, 1Sh.R				1 Kn.R							EOHI
36	388/11	21	M	7.30 PM	R	SF	No	11 D		2		AF.R,L		SD/SA				1	1	1	SPL ,	2				1 Kn.R							EOMI
37	702/11	29	M	9.30 AM	R	SF	No	2D	T.R					SA					1S	Rb.L				A,FA.L	Hum. L			I.L						EOMI
38	704/11	45	M	2.30 PM	R	F.bus	No	1 D		1	2	AF.R,L		SD/ED	ICH	CR			1			Elb,Sh.				l,Kn.R							EOHI
39	714/11	24	M	6;00 AM	R	SF	yes	18 D		2	2S		C5,6	SD/SA																			EOCSI
40	716/11	31	M	6:00 PM	R	SF	No	8 D	T.R	2		T.R		SD/SA								H,A,W. R				Kn.R		2					EOHI
41	718/11	31	M	7:15 AM	R	Lor	No	2 mon				T.R		SD		CR																	EOHI
42	723/11	42	M	11:00 AM	R	Car	No	2 H		1		T,O,PF.R		ED/ SD			AD.L									Ak.L							EOHI
43	748/11	54	M	11:30 AM	R	Car	No	15 D						SD	lac	CR										Ft.L							EOHI
44	764/11	23	M	3:30 AM	R	F. Car	yes	36 H	Ch.R								AD. R,L	1	1		LIV	Sh,Elb, W.R				Kn.R							EOBIA
45	765/11	25	M	3:00 AM	R	Car	No	28 D					C4,5	SD											BB.L	Kn.R							EOCSI
46	778/11	26	M	8:30 AM	R	Lor	No	7 D				F,AF.L		SD/SA/								Sh.L				Kn.R,L							EOHI
47	779/11	28	M	10:15 AM	PR	Lor	No	3 D	T.R	1		MF.R		ED/SD/ SA	ICH							Sh.R,L			Hum. R								EOHI
48	808/11	35	M	3:30 PM	R	Car	No	4 D	T.L	2		T.L		SD	IVH	CR				Rb.R		Sh,H.R				Ft.R							EOHI
49	813/11	35	M	10:10 PM	R	bus	No	4H		1		PF.L,O		SD				3				Elb,FA.				Kn.L							EOHI
50	816/11	21	M	8:40 AM	R	bus	No	30H		2	SS	MF.R		ED	ICH							SH,Elb,											EOHI
51	835/11	50	M	7:30 PM	R	SF	No	15D	T.R	1	1 S			ED/ SD/ SA				1		Rb.R						T.R							EOHI
52	839/11	28	M	7:15 AM	R	R.car	No	2 D		1	2	F,MF.R		SD/ SA	ICH							Elb,H.R											EOHI
53	843/11	49	M	5:45 PM	R	R.car	No	7 H		1	2	T,MF.L		SD/ SA								Elb.L											EOHI
54	847/11	21	F	5:00 PM	R	F. Lor	No	3 D						SD/ SA						Rb					Hum.								EOHI
55	850/11	30	M	5:00PM	R	R.car	No	20 M	F.R	2	2		C4,5	SD/ SA								Elb,W. R				T.R							EOCSI
56	854/11	27	F	10:15 AM	R	R.Lor	yes	2 H	FT.R				C4,5		IVH						Lun	A,FA.R				Kn.R							EOCSI
57	862/11	22	M	6:30 AM	R	R. car	No	12 H						SD/ SA			CT,A					FA.L				T,Kn.R			Fem.			PS	SHMI
58	867/11	29	M	9:00 AM	R	SF	No	1 D		1	1			SD/SA												l.R							EOHI
59	869/11	23	M	4:00 PM	R	F. Car	No	3 D	Fa.R	1	1S	AF.R,L		SD/SA								FA.L											EOHI
60	870/11	49	M	8:00 AM	R	F. Lor	No	1 D		1				SA		CR										T,l.R			Fem	RT		1	SHMI

61	905/11	30	M	6:00 PM	R	F. Car	No	3.30 M		1												E,FA.L								T.L		PS	EOHI
62	911/11	19	M	11:30 AM	R	SF	No	3 H					O	SD/SA																			EOHI
63	917/11	26	M	1:00 PM	R	F.Car	No	2 H										Lu				FA,W,H				Kn.R,L						PS	SHMI
64	923/11	32	M	8:00 PM	R	SF	yes	6 D						SA			CT.R			1 Rb		Sh.R				Kn.R							SHMI
65	941/11	40	M	3:30 PM	R	F. Car	No	4 D		1		T.R		SD/SA												Kn.R,L							EOHI
66	942/11	35	M	2:40 PM	R	R. car	yes	22H		1			C5							1 Rb									BB.R	I.R			EOMI
67	958/11	45	M	8:30 PM	PR	SF	No	2 D	Fa.R	1	1			SD/SA		CR						Elb.L				Kn.R,L							EOHI
68	961/11	28	M	10:15 PM	R	R. car	No	2 H		1		1		ED/SD/												Kn,I.L							EOHI
69	984/11	46	M	3:15 PM	PR	R. Lor	yes	4 D		1		MF.R,L		SD/SA			CT.L																EOHI
70	986/11	38	M	9:30 PM	R	R. car	No	3 D		1	1	PF.L		SD/SA												Th,A.R							EOHI
71	988/11	18	M	7:00 PM	R	F. bus	No	19 H	FT.R	1		1T.R		SD								Elb.L,Sh.R											EOHI
72	989/11	29	M	1:15 AM	R	F. van	No	7 H			1					CR												lac.L	BB,A				EOHI
73	999/11	35	M	3:00 PM	R	SF	No	14 H		1		Mn		SD/SA	IVH							Sh,Elb.				Kn,I.R							EOHI
74	1024/11	40	M	9:00 PM	R	F.car	No	8 D			H.R	F.R		SD/SA		TR																	EOHI
75	1026/11	37	M	8:00 PM	R	F. bike	No	1 D									CT.R											T.R,	fem,			PS	SHMI
76	1027/11	46	F	11:30 PM	PR	F. car	No	8 H			FA.R		BB.R,C							Rb.R,												1	SHMI
77	1210/11	25	M	7:00 PM	R	SF	No	52 H	Fa.R	1				SD/SA								1 FA.R				Kn,I.R							EOHI
78	1218/11	21	M	6:30 PM	R	F.Lor	yes	2 H														Elb.R,				Kn,I.R						r.R,L;S	SHPI
79	1219/11	27	M	12:30 AM	PR	Skd	No	2 D		1				ED/SD								Sh.R											EOHI
80	1221/11	29	M	12:00 AM	R	F.bike	yes	30 M		1		MF,T.R		ED/SD/								SH,Elb,				AK.R							EOHI
81	1232/11	32	M	8:00 AM	PR	Skd	No	2 D		1		P,PF.R		SD																			EOHI
82	1237/11	50	M	9:15 PM	R	F.bike	No	2 H		1		TP.R		SD								Sh.R				Ft.L							HI
83	1238/11	21	M	11:25 AM	R	R. car	No	6 H			1	F.R		SD/ SA														T.I.R	Fem.				EOMI
84	1244/11	35	M	10:30 PM	R	F.Lor	No	3 D		1				SD/ SA		CR						Elb.R				Kn.R							EOHI
85	1267/11	28	M	1:00 PM	R	F. Car	No	1 D		1				SA								H,FA.L				Kn,T.L		Ft.L					EOHI
86	1289/11	42	M	1:35 PM	R	F. Lor	No	1 H						SD						2 Rb	LIV	Elb.R,						Ft.L	T.R				MI
87	1293/11	29	M	7:15 AM	R	F. van	No	40 Ms		1		1 T, MF.R		SD/ SA								Sh,H,W				1 Kn.R							HI
88	1294/11	28	M	2:00 PM	R	F. Lor	No	15 H	Fa.R	1		MF, PF.R,L		ED/ SD/ SA						1 R		Elb,H.R,L; Sh,A.L				2 Kn.L							EOHI
89	1298/11	22	M	11:30 AM	PR	F. Car	No	2 D			1 S	2P.L		SD / SA		CR				4		H,FA.L		H.L	BB.L	3 F.L		1 Ft					EOHI
90	1317/11	26	M	4:30 AM	R	SF	No	3 D	Ch.R	1	1			SD / SA								FA.R,Elb,W.L				A,Ft.R; Kn.L							EOHI
91	1318/11	38	M	2:00 PM	R	F.bike	No	4 D	Fa.L	1	1			SD / SA								Elb.L			MCP.L	Kn.L		hI.L	Fem.L				EOMI
92	1333/11	32	M	12:15 AM	R	F.bike	No	3 H	Chk.R										Gr	1	ABD	Elb,H.R,L; Sh,A.L						Kn.R	Fem.R	T.R		1	SHMI
93	1338/11	33	M	9:00 PM	R	SF	yes	36H		1		T,MF.R		SD								H.R											EOHI
94	1339/11	28	M	1:45 PM	R	F. bus	No	1 H	T.R	2	1	MF.R		SD / SA	Lac 1												T.R	T,I.R		I.R			MI
95	1355/11	19	M	10:30 AM	PR	SF	No	7 D	F.L					SD/ SA												I.L							EOHI

96	1356/11	35	M	8:45 AM	PR	F.bike	yes	36 H	T.R	1				SD / SA	Lac 1	CR				Rb		H.R				Kn.R,L							EOHI
97	1362/11	25	F	5:45 PM	PR	F. Lor	No	4 H	T.R	1	1	1 T, MF.R,L		SD/ SA								Elb.R			BB.L	Kn,T.L						PS	EOMI
98	1366/11	29	M	5:50 PM	R	F. Car	No	2 H	F.L	1	1			SD / SA					Per	2		Elb.L, FA.R			BB.L	I,T.L						PS	SHMI
99	1367/11	23	M	10:45 AM	R	F.bike	No	2 H	T.R	1		1 T, MF.R,L		ED / SD/ SA								FA,W.R				Kn.R,L							EOHI
100	1368/11	33	M	2:45 PM	R	SF	No	2 D	F.R	1				SD												A,Kn.R							EOHI
101	1437/11	32	M	8:00 AM	R	F. Lor	yes	15 D		1				SA					1S	1		A.L			Hum.								EOHI
102	1473/11	40	M	12.30 PM	R	SF	No	4 H						SA				1		1		FA.L				Kn.L	T.L		Fem.			1	SHMI
103	1475/11	26	M	10.30 PM	R	SF	No	30 H		1	1	AF.L		ED,SD												Ft.R			BB.R				MI
104	1477/11	28	M	10.30 PM	R	Lor	No	12 D	Chk. R		1			SD,SA						1		Sh,A,FA .L				Kn.R							EOHI
105	1479/11	50	M	10.00 PM	R	SF	No	2H	FPT. L	1		FR AF, MF.L		SD,SA								H.R				T,Ft.R, I.L							HI
106	1480/11	40	F	10.15 AM	PR	SF	No	1 D	T.R	1		MF.R		SD,SA												Kn.R							EOHI
107	1482/11	32	M	7.30 PM	R	SF	No	19 H		1			C3,4	SA								Elb.R,L				Kn.L							MI
108	1483/11	27	M	8.00 PM	R	SF	No	8 H	FPT. L	1		F, MF.R,L		ED,SD								A.R,L				Kn.R							HI
109	1488/11	31	M	5.00 AM	R	SF	No	5 H		1		MF, T.R		SD,SA								Sh,Elb,				Ft.R							HI
110	1494/11	20	M	7.30 PM	R	F. Lor	No	6 H													2 Lit	FA,Elb.				Kn.R							EOHI
111	1501?11	38	M	12.15 PM	R	SF	No	4 H	Fa.L	1				SD, SA														I.L					HI
112	1518/11	25	M	11.30 AM	R	F. Lor	No	5 D			1S			SD, SA														Kn.L					EOHI
113	1520/11	27	M	10.30 PM	R	F. Car	No	6 D	T.R					SD, SA								Sh.R											EOHI
114	1553/11	39	M	12.30 PM	R	car	yes	1 D	PT.R	1		TP.L		ED, SA												Kn.R							HI
115	1583/11	40	M	12:00 AM	R	Lor	yes	3 H													LUN	Elb.R				Ft.R			M.tr.				MI
116	1591/11	26	M	2.00 PM	PR	F. Car	No	5 D			1	MF.L		SD, SA								Elb.L				T.R,Kn							HI
117	1630/11	34	M	7.20 PM	PR	F.	No	2D		1			C4,5								100ml	H.R				I.R							EOCSI
118	1649/11	42	M	10.45 PM	R	F.	No	5 D		1				SD, SA								Elb.R				I.R		Kn.					EOHI
119	1653/11	40	M	2.00 AM	R	SF	No	5 D	F.R		1 Fh			SD, SA																			EOHI
120	1673/11	23	M	2.15 PM	R	van	No	1.5 D	Fa.R													Elb.R				Kn.R							EOHI
121	1699/11	26	M	9.30 AM	R	SF	No	1 D		1	1 Fh			SD																			EOHI
122	1828/11	52	M	4.00 PM	R	SF	No	11D	FT.R					SD,SA		TR						Elb,H.R				Ft,I.R		1 Ft					EOHI
123	1827/11	25	M	3.00 PM	R	SF	No	7D	Fh.R, L	2		AF.R,L		SD,SA	ConFr	TR						1 H.R											EOHI
124	1849/11	47	M	10.15 PM	R	bus	No	5D		2					ICH	TR										I.R,L							EOHI
125	1872/11	49	M	7.30 PM	R	SF	No	5D						SD	ICH							Elb.R,L				Ft.L							EOHI
126	1877/11	26	M	1.00 AM	R	car	yes	36 H														H.R			FA.L	T.L					Abv		EOLLI

127	1887/11	35	F	7:15 AM	PR	SF	No	16 H	F.R			PF.R		SD	1 Con					1		FA.R				Kn.R,L							EOHI
128	1889/11	38	F	10:00 PM	R	F. Car	No	24 H		1	1S	1 TP,		SD/ SA						1 R		Sh,FA.R			1Cl	Kn,Ft.		1 Ft					EOHI
129	1892/11	29	M	7:15 PM	R	F.car	No	1 D		1		1T.L		SD/ SA								Sh.L							BB				EOMI
130	1897/11	14	F	9:20 AM	PR	F. Lor	No	1 H		1				SD / SA							2 LIV	FA.L,											MI
131	1907/11	65	M	2:00 PM	PR	F. Lor	No	4 D			1S									1 R		Sh.R,			1 Acr	T.R			Fem,	T.R			EOMI
132	1909/11	28	M	6:30 PM	PR	F. bus	No	1 D	FPT. R	1		1TP, MF.R										Elb.R				l,Kn.L							EOHI
133	1912/11	38	M	8:15 PM	R	SF	No	1 H		1	1	MF.R		SD/ SA								Elb,W.				Ft,I.R							SHMI
134	1956/11	29	M	2:00 PM	R	F. Car	No	7 H		1	1			SD/ SA												Kn,I.R,							EOHI
135	1959/11	41	M	9:00 PM	R	F. Car	No	3 D		1								Lun	2 R	LIV		1SH ,			1Cl	3 Mid							EOMI
136	1960/11	58	M	10:30 PM	R	SF	No	9 D	F.R,L				C5		ICH																		EOCSI
137	1961/11	41	M	9:00 AM	R	F.	No	3 D		2				SD/ SA							SPL					AK.R,							EOHI
138	1976/11	63	M	11:30 AM	R	F.bike	yes	8 D	Fh.R, L	2		1 T, AF.R,L								1 R,		Sh,FA.R				T.R, I.R,L							EOHI
139	2007/11	21	M	9:30 AM	PR	Bike	yes	4 D		2												A,FA.R			1 BB	Kn,Ft.		1 L	Fem.				EOLLI
140	2013/11	38	M	11.15 PM	R	F.	No	4 H		1		1 T, MF.R		SD/SA	2 Con							Elb,FA.											EOHI
141	2039/11	41	M	12:00 PM	R	F.Aut	No	3 D		1		1 F.R		SD/SA								SH,H.R				Kn.L							EOHI
142	2040/11	22	F	4:00 PM	PR	bus	No	29 D		1				SD/SA							LIV	H.R				Ft.R							EOMI
143	2059/11	70	M	7:15 AM	PR	F. Car	No	Spt		1	1	2T,		SD/SA												A.L		I.R					EOHI
144	2062/11	27	M	8:00 AM	PR	Bus	yes	1 H													SPL												SHMI
145	2066/11	54	M	4:30 PM	R	F. Lor	yes	2 H			1	T.L									SPL												EOHI
146	2070/11	46	M	7:00 PM	R	Bus	No	6 D	F.R		1			SD		CR				1R												r.L	EOHI
147	2082/11	45	M	7:50 PM	R	F. Car	No	9 D	T.L	1		MF.R,L		SD/ SA	2 LAC	CR						Sh.L				Ft.R,L							EOHI

Fig. Dark brown irregular abrasion over the outer aspect of right elbow

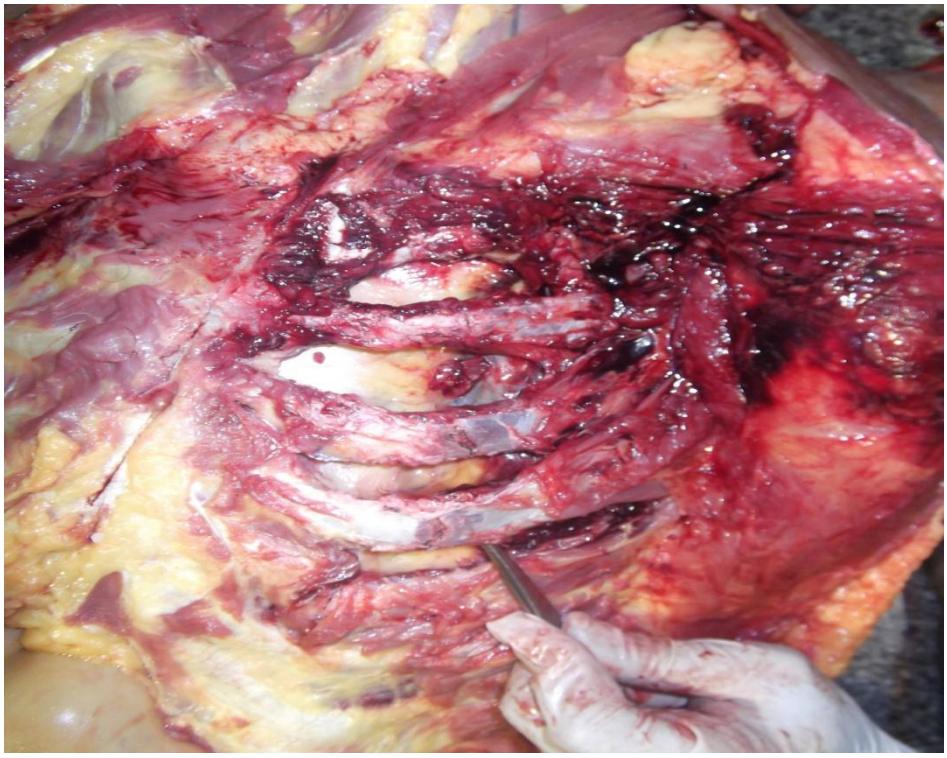


Fig. Fracture of left upper ribs with surrounding soft tissue contusion

Fig. Two dark brown irregular Abrasion injury on the left shoulder

Fig. Large Extradural Hematoma over the right fronto-parieto- temporal region

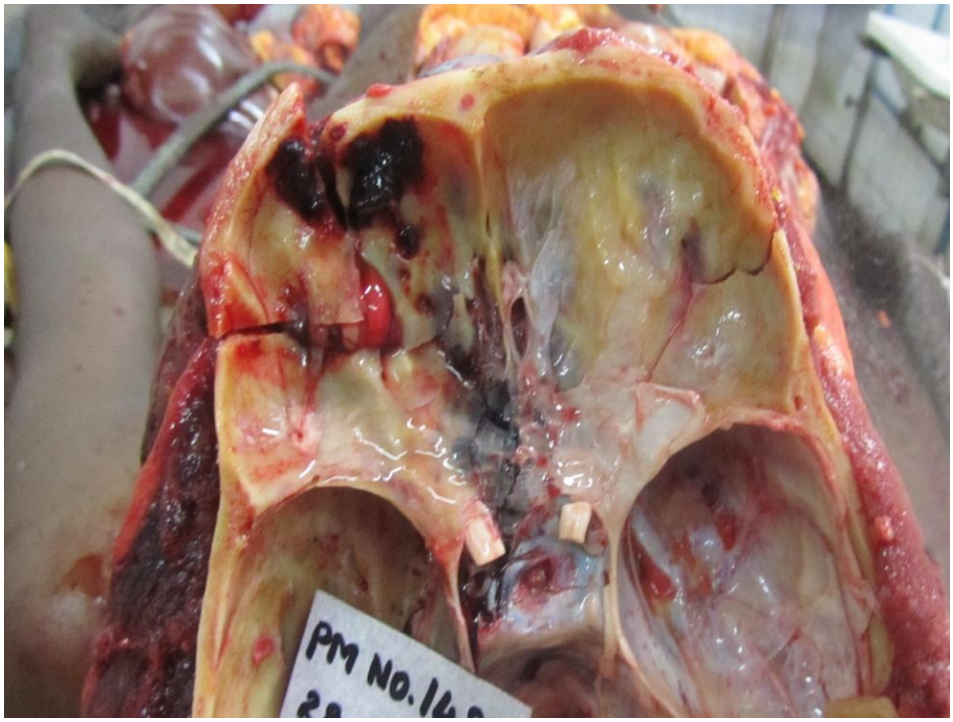


Fig . Communited fracture involving the floor of the left anterior cranial fossa and middle cranial fossa

Fig. Pelvic haematoma due to underlying pelvic bone fracture

Fig. Diffuse dark red contusion over left fronto pareito temporal region of the scalp

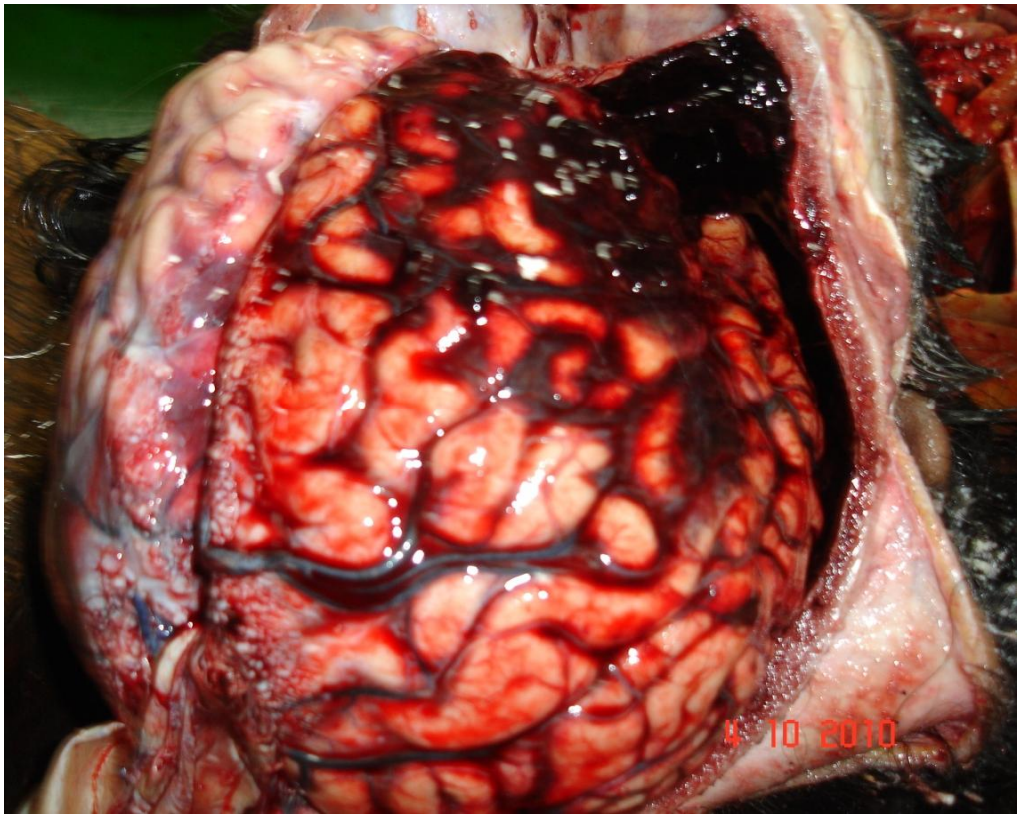


Fig.Sub-dural haemorrhage over the right cerebral hemisphere.

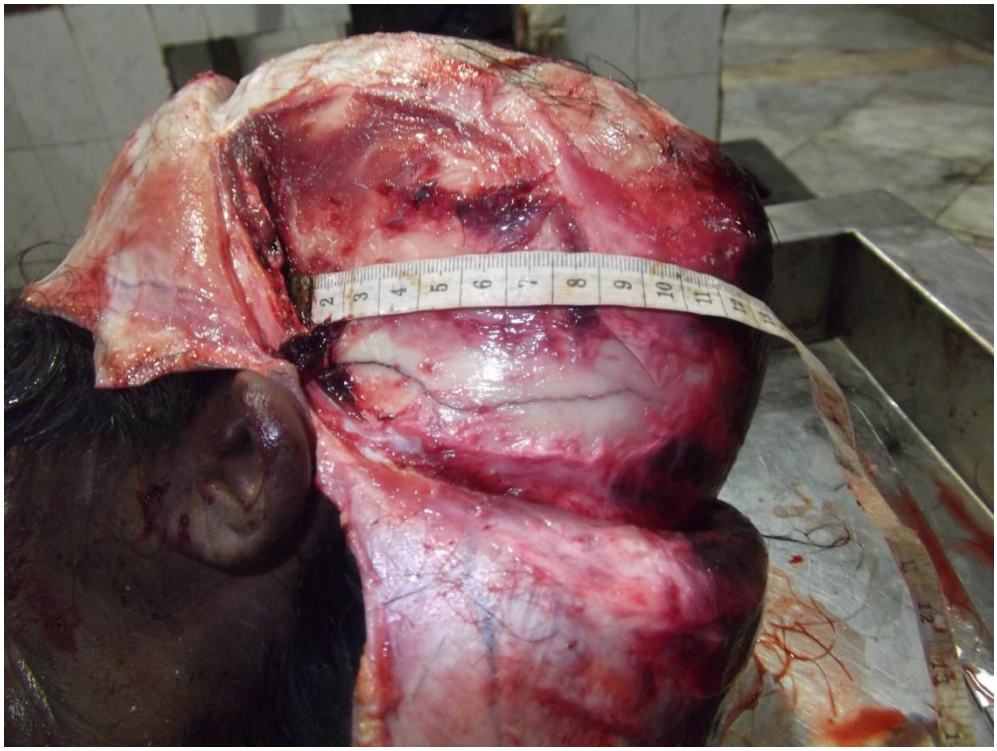


Fig. 9 cm linear fissured fracture on the posterior part of left temporo-parietal bone

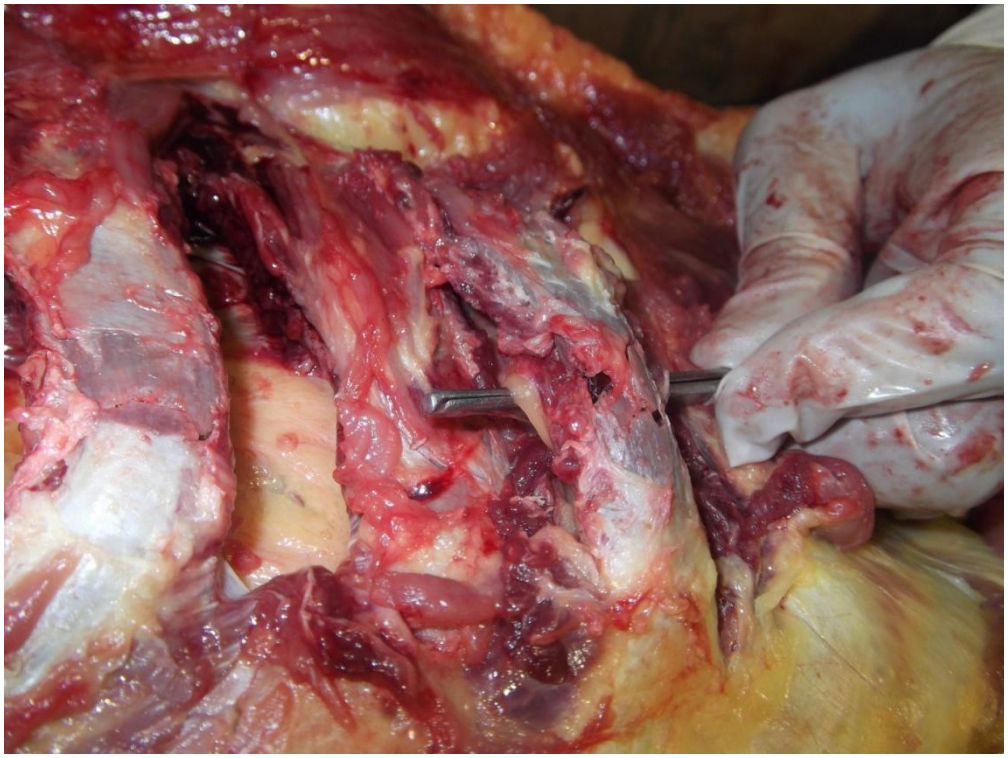


Fig. Rib fracture in mid clavicular line

Fig. Curvilinear craniotomy surgical sutured wound over right fronto-parieto- temporal region of the scalp

Fig.Dark brown abrasion on the right upper arm

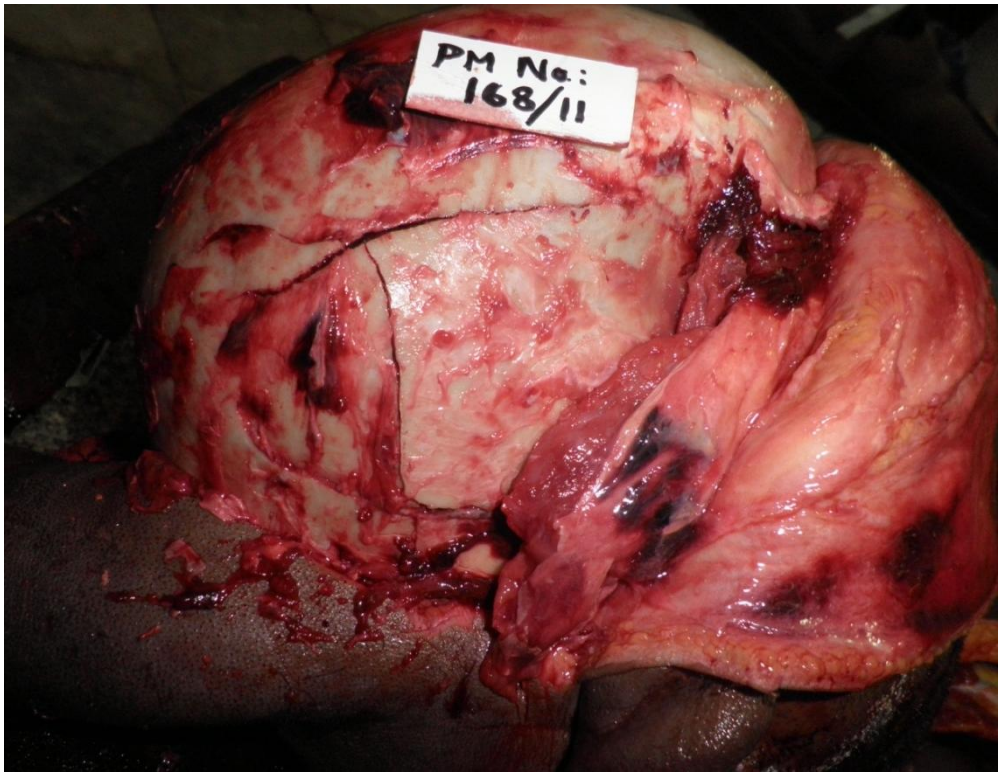


Fig. Communitted fracture of right temporo-parietal region

Fig.Graze abrasion over outer aspect of upper part of left side of the chest

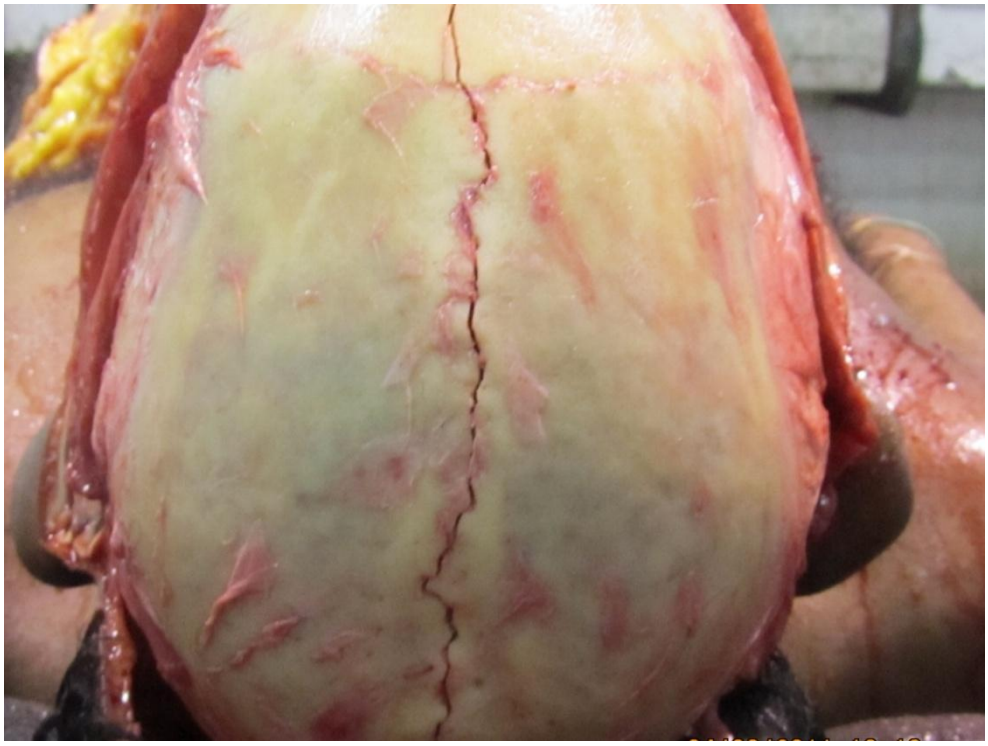


Fig.Diastatic fracture involving the sagittal suture

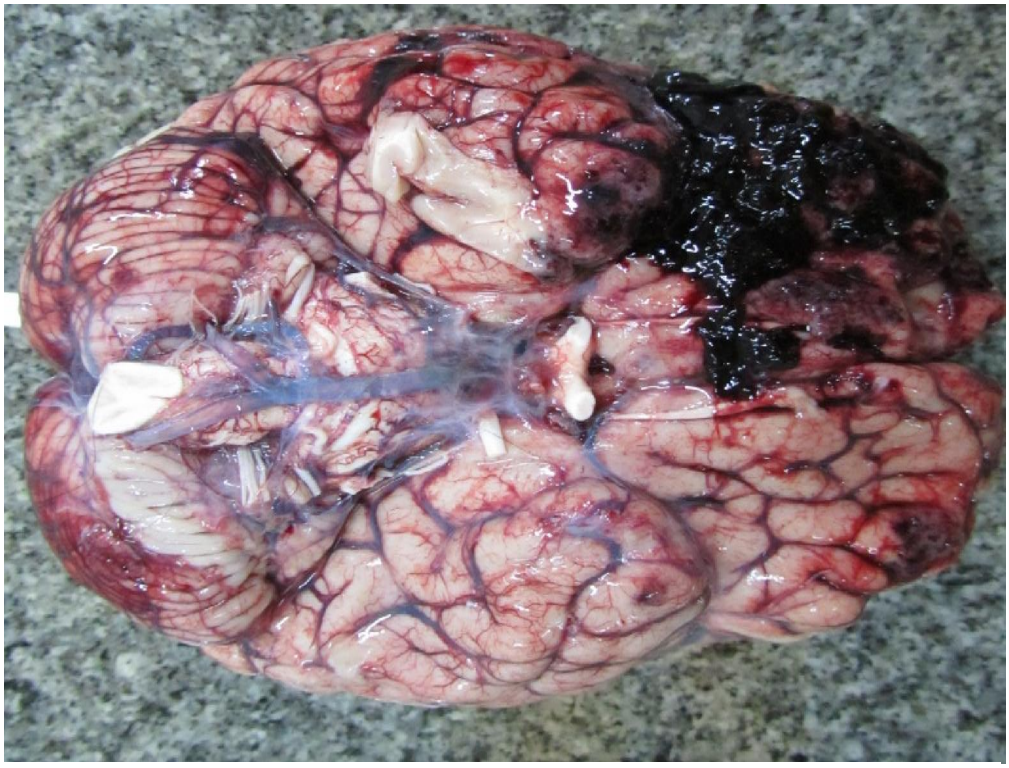


Fig.Right frontal lobe haematoma with underlying laceration

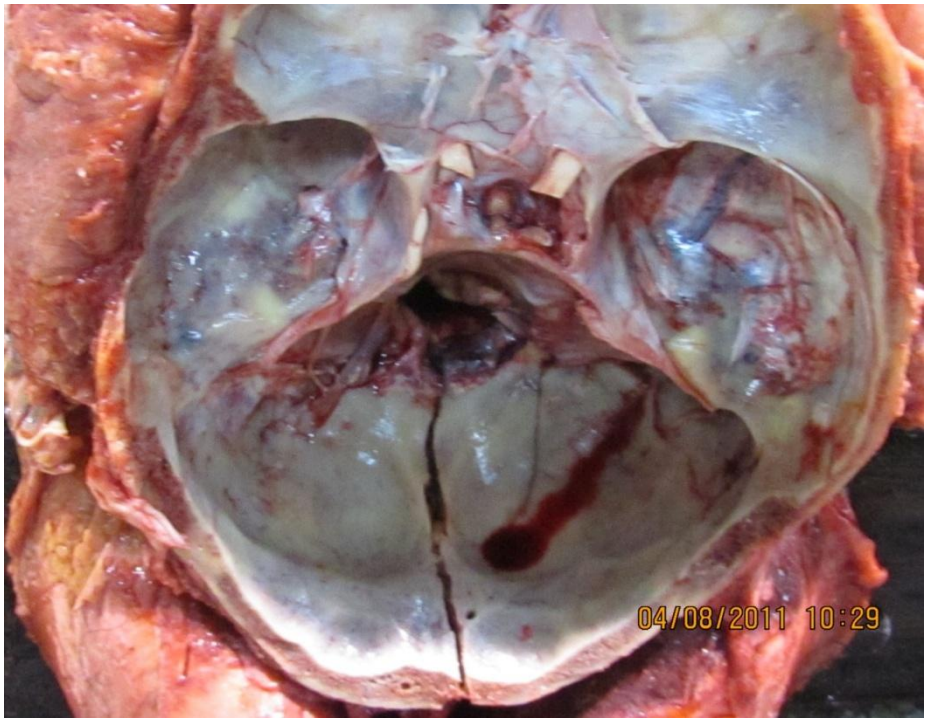


Fig.Fracture floor of posterior cranial fossa

Fig. Craniotomy wound with bone flap insitu fixed with metallic screws

Fig. Diffuse dark red scalp contusion all over the scalp.

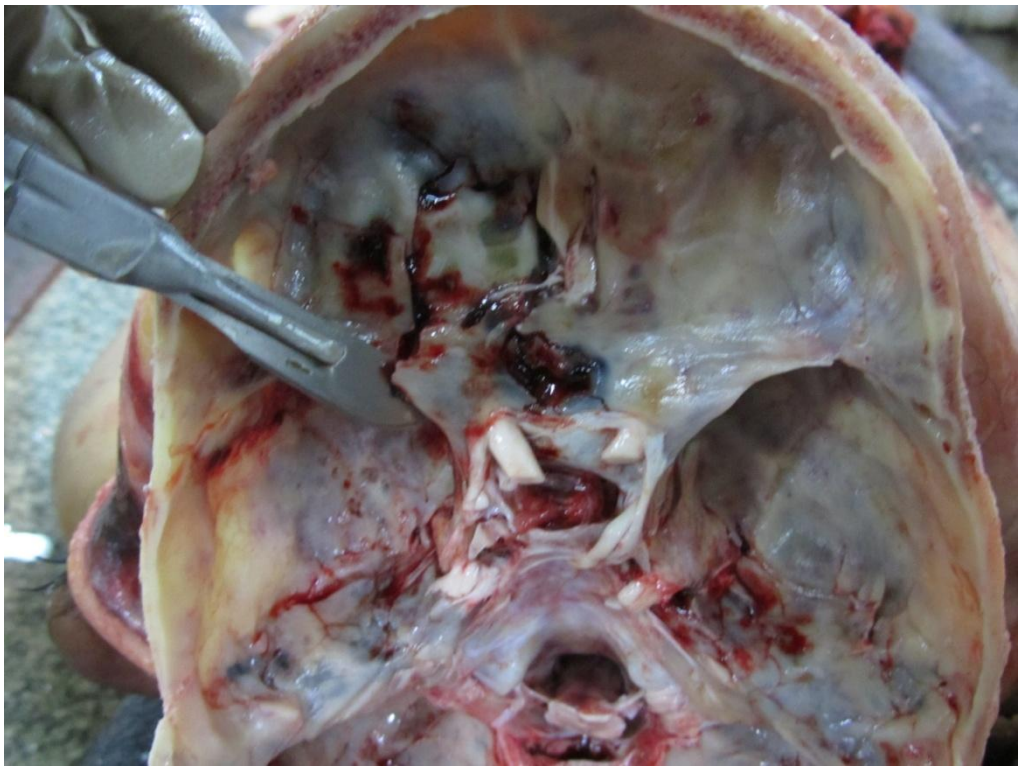


Fig . Fracture floor of the left anterior cranial fossa.

Fig.Dark red diffuse sub-arachnoid haemorrhage all over the brain surface.

Fig. Contused laceration over the right frontal lobe

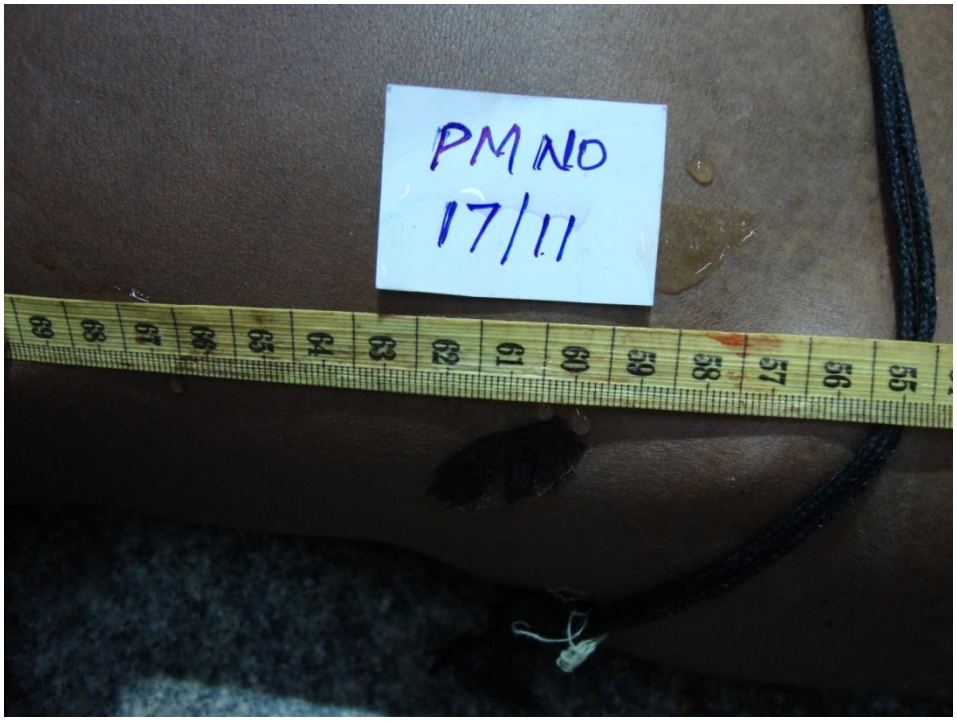


Fig. Abrasion over right iliac crest.

Fig. Large diffuse sub-dural haemorrhage

Fig. Abrasion over outer aspect of right ankle

Fig. Abrasion over outer aspect of right knee

Fig. Laceration over outer aspect of lower third of right thigh

Fig. Cardiac contusion because of overlying rib fracture

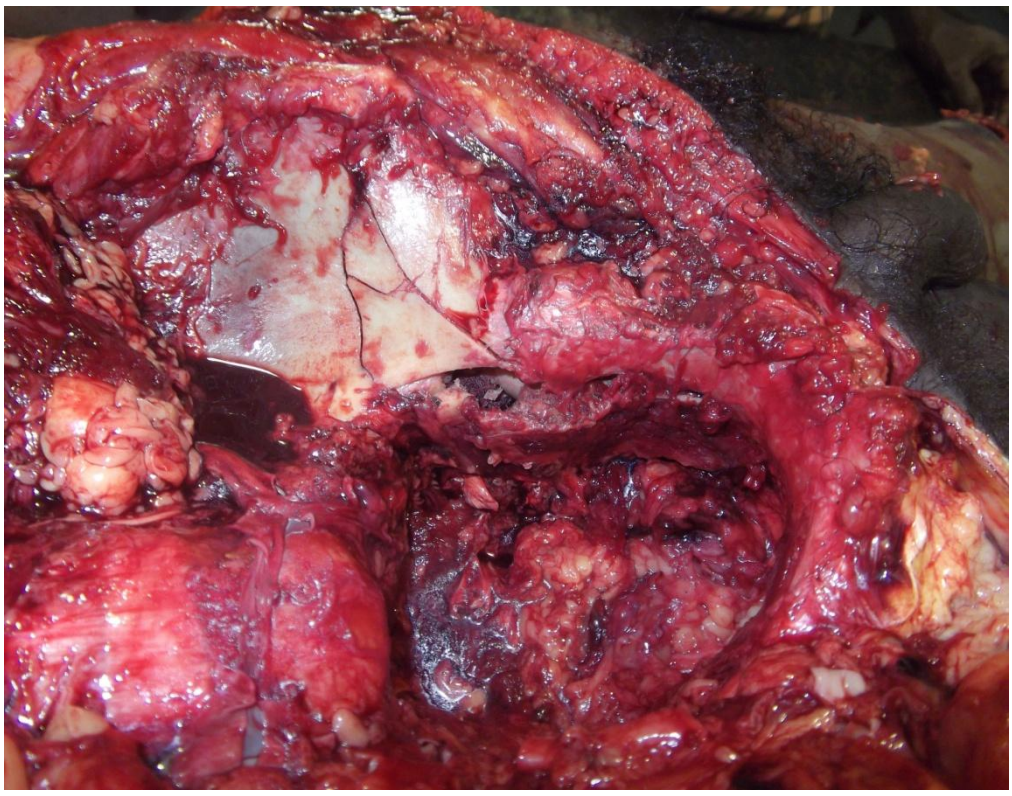


Fig. Pelvic fracture involving the left acetabulum

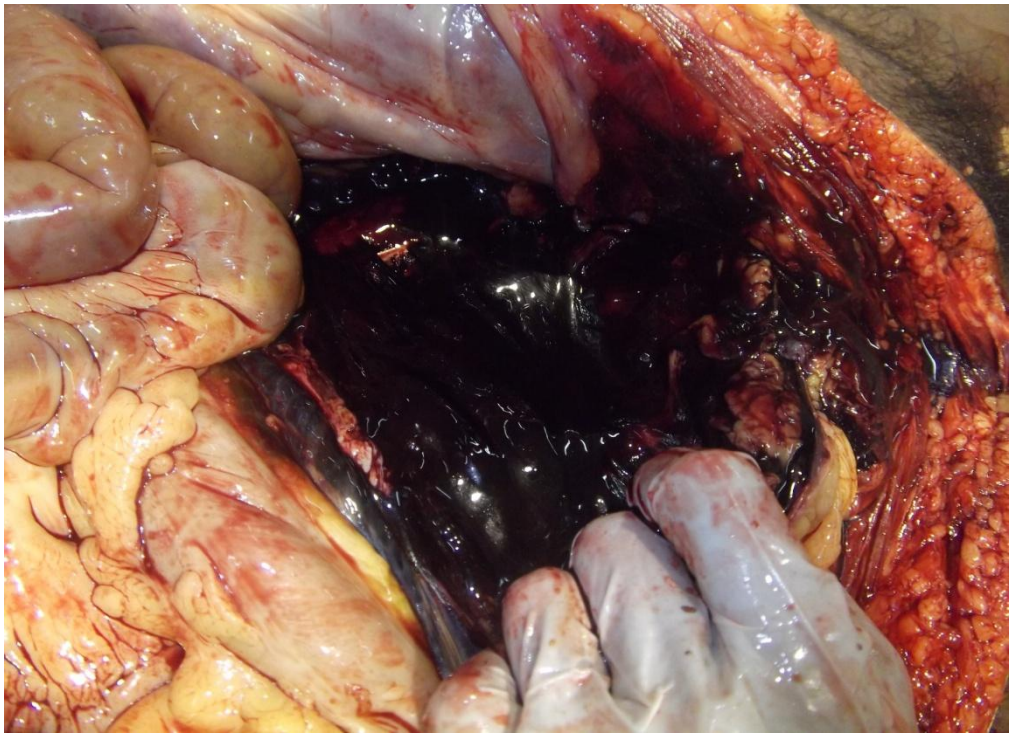


Fig. Large retro peritoneal haematoma

RESULTS AND ANALYSIS

Totally 147 motorcyclist victims were included in this study in which demographic factors such as age, sex, time of accident, manner of collision, period of survival, injury pattern were analysed. Total number of helmet users and non helmet users and pattern of injuries were analyzed. External and internal injuries among the victims were analyzed according the different regions of the body. Pattern of fatal injuries and the cause of death were also analysed.

Age distribution of the study sample:

Age group	Rider	Pillion rider	Total
< 20	3	2	5
20 - 30	54	11	65
30 - 40	31	5	36
> 40	35	6	41

Victims of age less than 20 years were found to be equal to 5(3.4 %), 20-30 years were 65(44.2%), 30-40 years were 36(24.5 %) and above 40 years were 41 (27.89%).

Sex distribution of the study sample:

	Male	Female
Total fatalities	138	9

Out of 147 victims males comprised 138(94%) and female comprised 9(6 %). Significant no of victims of road traffic accidents were males. P value <0.001.

Frequency of riders and pillion riders:

Sex	Rider	Pillion rider	Total
Male	119	19	138
Female	3	6	9
Total	122	25	147

Total number of riders were 122(83%) and pillion riders were 25(17%). Significant proportion among the riders were males 119(97.5%). P value <0.05. Females were 3(2.5%). Among the pillion riders males were 19(76%) and females were 6(24%).

Time of accident:

Time of Accident	Rider	Pillion rider	Total
3-6 AM	6	0	6
6-11 AM	17	10	27
11AM-3PM	24	4	28
3PM-6PM	18	3	21
6PM-10PM	38	5	43
10PM-3AM	19	3	22
Total	122	25	147

Among the total accidents 6 occurred between 3 and 6 AM, 27 between 6 and 11 AM, 28 between 11 AM and 3 PM, 21occured between 3 PM and 6 PM,43 from 6 PM to 10 PM and 22 occurred between 10 PM and 3 AM.

Percentage of fatalities among riders peaks during 6 to 10 PM viz., 31% while percentage of fatalities among pillion riders peaks during 6 to 11 AM viz., 40%.

Self fall	Rider	Pillion rider
3-6 AM	3	0
6-11 AM	3	4
11 AM-3 PM	6	1
3-6 PM	2	0
6-10 PM	18	1
10 PM-3 AM	4	1

Among those got hurt by self fall who were 43(29.25%) in number 19(44%) of accidents occurred between 6 and 10 PM out of which only 1 is a pillion rider.

Manner of the accident:

Out of 147 cases, manner was known for 72 cases 49%. 61/72 were frontal and 11/72 were rear collisions.

Manner of collision	Total	Rider	Pillion rider
Front impact	61	51	10
Rear impact	11	9	2
Unknown	32	26	6
Self fall	43	36	7

Out of known 49%, 84.7% had frontal impact and 15.3% had rear impact. Among 72 cases, 60(85%) are riders whereas 12(15%) are pillion riders.

Survival period of the victims:

Period of Survival	Total	Rider	Pillion rider	Major cause of death
Spot dead	2	1	1	HI
Brought dead	1	1	0	SHMI
<12 H	40	34	6	EOHI
12-24H	9	8	1	EOHI
1-4 D	56	43	13	EOHI
4-14 D	29	26	3	EOHI
>14 D	10	9	1	EOHI, EOCSI

Regarding the survival period of the victims, 2(1.3%) were spot dead and 1(0.6%) was brought dead. Those who survived less than 12 hrs were 40(27.2%), between 12 to 24 hrs were 9(6.1%), 1 to 4 days were 56(38%), 4 to 14 days were 29(19.7%) and above 14 days were 10(6.8%) in number.

More fatalities within short period of interval occurred in less than 12 hrs viz., 40(27.2%).

Regional distribution of injuries:

Regions	Abrasions	Contusions	Lacerations	Fractures
Head & Neck	63	100	50	85
Thoraco- Abdomen	14	6	9	26
Upper Limbs	94	20	3	17
Lower Limbs	96	4	24	24

Among the external injuries, abrasions were seen 63 cases over Head and neck, 94 cases over Upper limb, 96 cases over Lower limb and in only 14 cases over Thoraco- abdominal region.

Contusions were seen 100 cases over Head and neck, 20 cases over Upper limb, 6 cases over Thoraco- abdominal region and in only 4 cases over Lower limb.

Lacerations were seen 50 cases over Head and neck, 24 cases over Lower limb, 9 cases over Thoraco- abdominal region and in only 3 cases over Upper limb.

Fractures were seen 85 cases over Head and neck, 24 cases over Lower limb, 26 cases over Thoraco- abdominal region and 17 cases over Upper limb.

Distribution of abrasions:

Regions	Right	Left	Bilateral	Total
Head & Neck	44	12	7	63
Thoraco-Abdomen	6	5	3	14
Upper Limbs	54	24	16	94
Lower Limbs	52	23	21	96

Out of 147 cases 55-70 % of the abrasions all over the body were found on the right side of the body.

Injuries of Head and Neck:

Head injuries	Total	Riders	Pillion riders
Abrasions	63	53	10
Contusions	100	82	18
Lacerations	50	42	8
Skull Fractures	74	60	14
Meningeal haemorrhagess	105	89	16
Cerebral Injuries	24	19	5

Head and neck injuries were distributed as abrasions in 63 cases, contusions in 100 cases, lacerations in 50 cases, Skull fractures in 74 cases, meningeal haemorrhages in 105 cases, cerebral injuries in 24 cases and surgical intervention were done in 23 cases. Meningeal haemorrhages and contusions lead the run.

Skull fractures	Percentage of fatalities
Frontal	14.96
Temporal	40.13
Pareital	4.76
Temporo-pareital	5.44
Occipital	7.48

Among the fractures of the skull Temporal bone suffers the most with 40.13% followed by Frontal bone with 14.96%. Occipital bone is the least affected with 7.48%. Among 74 skull fractures 61 were fissured and 13 were communited.

Meningeal hemorrhages	Percentage of fatalities
SDH	65.3
SAH	53
EDH	10.8

Among the meningeal injuries sub-dural haemorrhages were found in 65.3% followed by sub- arachnoid haemorrhagesin 53% of cases and extra-dural haemorrhages in 10.8%

Skull base fractures	Total	Rider	Pillion rider
ACF	14	14	0
MCF	37	27	10
PCF	7	5	2

Middle cranial fossa is most commonly fractured and posterior cranial fossa is least affected.

Thoraco-abdominal injuries:

Thoraco-abdomen	Total	Rider	Pillion rider
Abrasions	14	13	1
Contusions	6	6	0
Lacerations	9	9	0
Fractures	39	32	7
Visceral damage	15	11	4
Perineum	2	2	0

Fractures are most frequent injury type of this region, 39 out of 147 cases, of which rib fractures constitute the most. Next common is injury to internal organs viz., 15/147.

Fractures	Total	Rider	Pillion Rider
Pelvis	13	11	2
Rib	26	21	5

9% of riders and 1.4% of pillions suffer pelvic fractures. 17.2% of riders and 14% of pillions acquired rib fractures.

Injuries of Upper limb:

Since the abrasions are the most common injuries and the fractures are the most severe form of injuries, as far as the limbs are concerned, they are taken into account for the analysis of their regional distribution.

Pattern of abrasions in Upper limb:

Region	Rider	Pillion rider	Total
Shoulder	31	3	34
Arm	7	4	11
Elbow	37	6	43
Forearm	27	10	37
Wrist	13	1	14
Hand	22	5	27

Among the upper limb injuries elbow with forearm constitute 54.4% of the total fatalities.

Pattern of fractures in Upper limb:

Skeletal region	Rider	Pillion rider	Total
Clavicle	2	0	2
Acromion	2	0	2
Humerus	3	2	5
Radius & ulna	4	2	6
Metacarpal	2	0	2

Among the fractures, radius and ulna suffered the most followed by humerus. The acromion and metacarpals were the least affected during road fatalities. Upper limb fractures are significantly higher in riders. P value <0.05.

Injuries of Lower limbs:

Pattern of abrasions in Lower limb:

Among the lower limb abrasions, knee is the most commonly injured part. That too more frequent among riders than pillions.

Region	Rider	Pillion rider	Total
Foot	19	3	22
Ankle	9	1	10
Leg	24	5	29
Knee	46	9	55
Total	98	18	116

Pattern of fractures in Lower limb:

Skeletal region	Rider	Pillion rider	Total
Femur	13	2	15
Tibia	3	0	3
Leg(BB)	8	1	9
Foot	2	0	2
Total	26	3	29

Among the lower limb injuries, fractures are one of the most severe form viz., common in femur(10.2%) followed by Tibia(8.1%) which includes both bone fractures also. Foot fractures the least common.

Distribution of Fatal injuries:

Among the total fatalities 63.8% suffer Meningeal haemorrhages, 13% cerebral injuries, 51% skull fractures, 6.8% Spinal injuries, 10.8% Lower limb fractures and 6.1% Pelvic fractures. The commonest being the skull fractures (51%). Followed by lower limbs, upper limbs,ribs, pelvic fractures.

Fatal Injuries	Rider	Pillion rider	Total
Meningeal Haemorrahges	80	14	94
Cerebral Injuries	15	4	19
Skull Fractures	58	17	75
Spine Injuries	8	2	10
Lower Limb Fractures	15	1	16
Pelvic Fractures	7	2	9
Crush Injuries	6	1	7
Visceral damage	11	4	15

Among the crush injuries(7{4.8%}) of the limbs, most involved are the lower limbs. The 4.9% of riders and 4% of pillions suffer crush injuries.

Frequency of Helmet usage:

Out of 147 cases, 116(79%) travelled without helmet and 31(21%) with helmet. Among those who not worn helmet 95(82%) were riders and 21(18%)

were pillions. Among those who worn helmet 27(87%) were riders and 4(13%) were pillions.

	Rider	Pillion rider	Total
Without Helmet	95	21	116
With Helmet	27	4	31

	Male	Female	Total
Without Helmet	108	8	116
With Helmet	30	1	31

Among those who not worn helmet 108(93%) were males and 8(7%) were females. Among those who worn helmet 30(96.7%) were males and 1(3.3%) were females.

Cause of death:

Cause of death	No. of fatalities	Helmet usage
HI	102	17%
MI	32	18.75%
EOCSI	7	42.80%
EOLLI	4	100%
EOBIA	1	100%
SHPI	1	100%

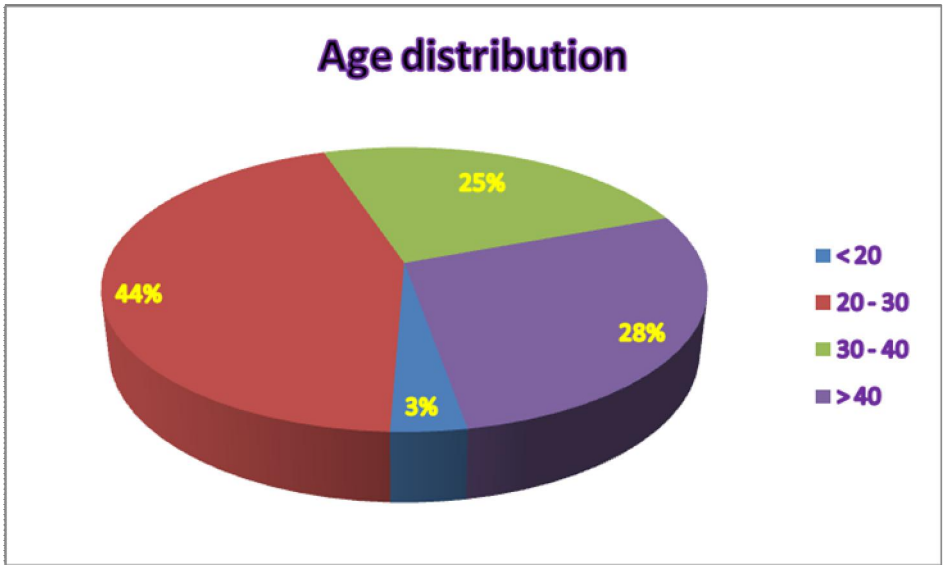
Head injury accounts for 69.3% of fatalities viz., the maximum, followed by multiple injuries viz., 19%. Whereas blunt injury abdomen and pelvic injury were the least.

Among the death toll of head injuries hardly 17% used helmets. Helmet usage is significantly higher in fatalities due to other causes.

DISCUSSION

Motorised two-wheelers are the most commonly involved road users who contributes to major burden of road traffic accidents in developing countries, owing to their least stability, higher speed and thrill seeking behavior of the riders “restless driving ”.[33,46]

Age distribution of the study sample:



Working and economically productive age group 20 to 40 69%. In all age groups, 80 to 90% were males as they are the breadwinners of the family. They constitute the largest fraction of those who use the motorized vehicles. Fraction of age less than 20yrs constitute only 5/147, out of which 3 were riders. 2 were pillions. They are mostly school and college going, having inadequate experience in riding two wheelers.

Among the age group 20 to 40 yrs 101/147 68.7%.among them age 20 to 30 yrs 65/101 64% viz., supported well by many other studies.[9,10,11,12]

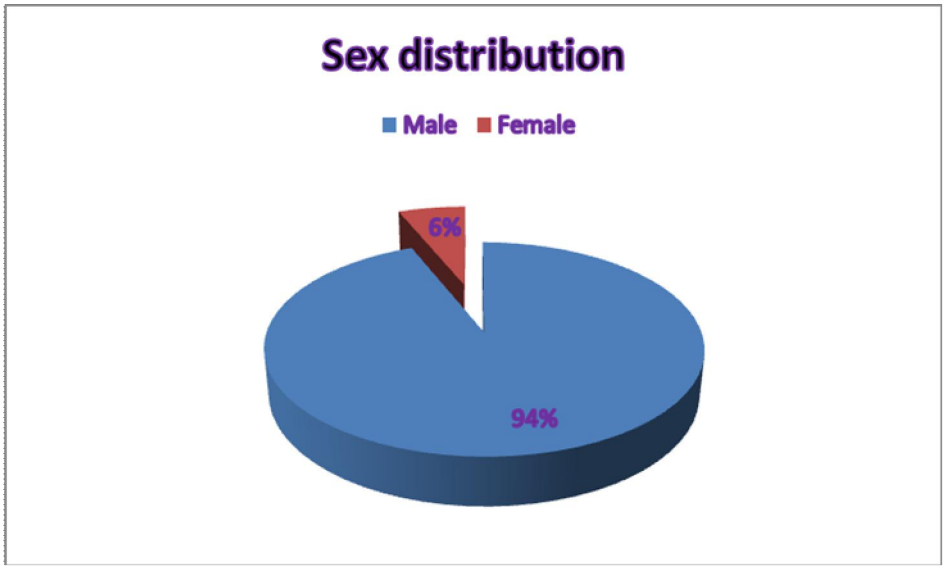
Young drivers and riders coupled with inexperience are the main prey of road traffic accidents. The factors which explain why the middle age people are involved in road traffic accidents include inexperience, risk exposure, risk taking behavior. Inexperience, plays a major role in contributing to road traffic accidents mainly during the first year of having learnt to drive a bike. They have poorly developed skills in controlling vehicle and they lack many of the perceptual and cognitive skills that are crucial for safe and effective motoring. Young riders often underestimate the risk level associated with certain situations or types of driving behavior . They over estimate their driving capacity to deal with such situations. Further they found difficulty in anticipating and accommodating other road users behavior. They were found to have a greater difficulty in coordinating the various tasks involved in the art of driving when compared to more experienced drivers. Young riders experience more peer pressure to engage in **"risky"** driving antics than older riders[47]. Young aged pillions influence drivers in speedy cornering or when attempting to overtake other vehicles. They engage in high risk driving just for the **"thrill"**. They have a high level of aggression; attention difficulties; sensation-seeking personality; high alcohol, marijuana intake and absence of parent imposed driving restrictions[(42).] The top 3 driver errors that comprise 85% of traffic accidents include speeding (41%), overtaking (24%) and inattentiveness (18%)[(43)] followed by excessive lane changing, failure to give way at intersections, multi tasking while riding etc..

Middle aged 30 to 40 were 36/101 (36%) . This age group who has to look after the family more exposed to road traffics for the following reasons. Dropping kids in their schools, homes, going for shopping, hospitals if any one in the family is sick, attending marriages, condolence, official visits ,

friends & relatives meet , going to banks to deal financial matters etc. Older drivers tend to drive less and cautiously. But due to defective vision, neurological deterioration and other co-morbid conditions they have slower reactions which might be expected to be involved in more accidents.

Sex distribution of the study sample:

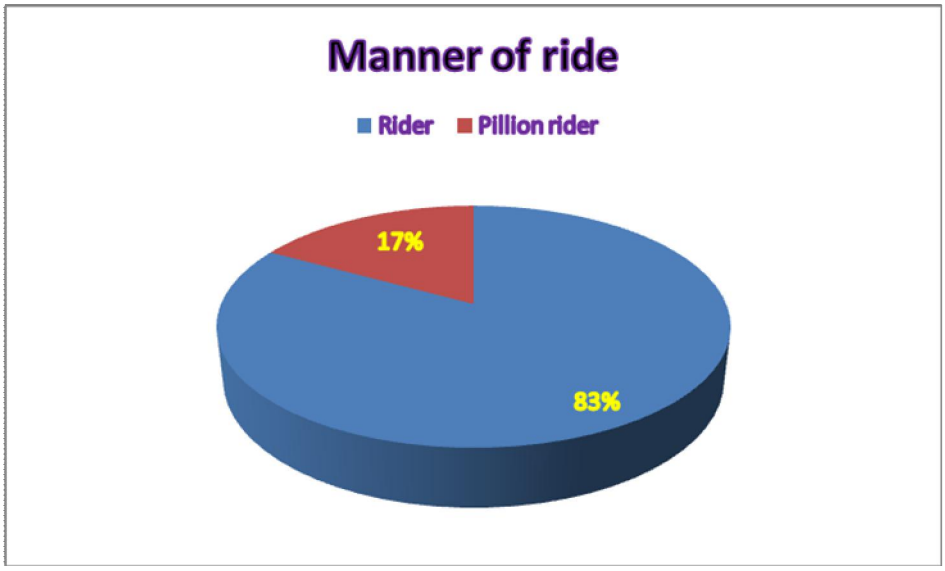
In my study, 94% were males which is well supported by other studies[20,21]. Since males are the breadwinners of the family they have to look after the family.



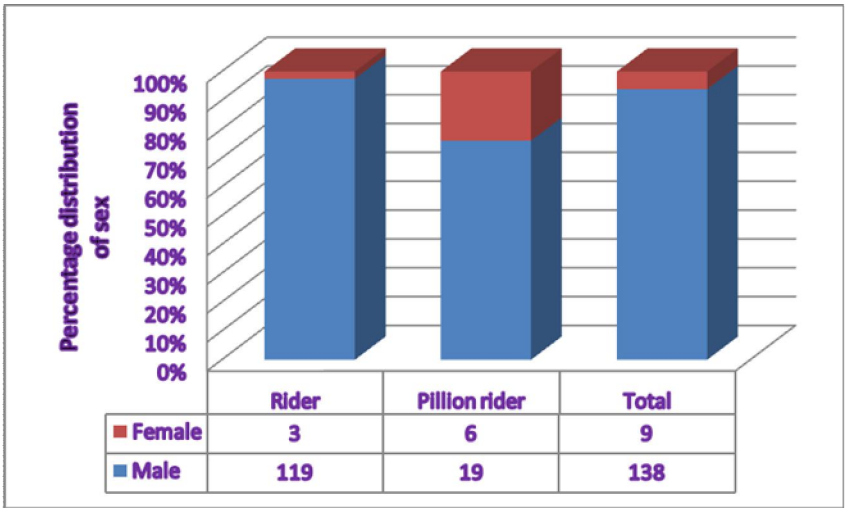
Factors for the increased risk of male drivers to be the victims include: hormonal influence leading to thrill-seeking, over-confidence, excess speed, late-night driving. Vehicle characteristics such as old, ill-maintained or borrowed vehicle also contribute.78% of all fatalities occur during first three years of driving.due to inexperience[13].

Frequency of riders and pillion riders:

As riders are the most frequent travelers of two-wheelers than pillions, they are affected in almost every road traffic accidents. In our study 83% were riders and 17% were pillion riders.



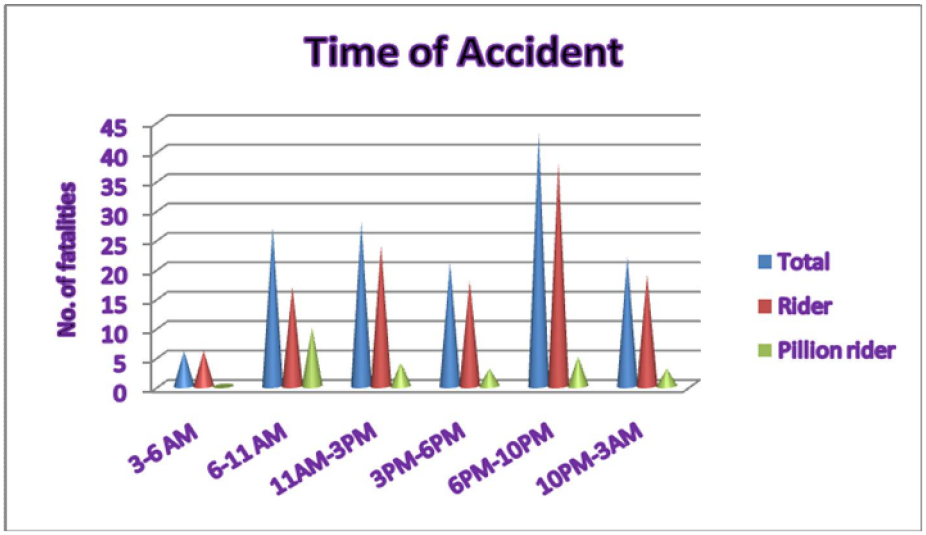
Among the male population 138 of the study Riders are 119 (86%). Pillion riders are 19 (13.73%). Among female population,3 out of 9 (33.33%) were riders and 66.66% were pillion riders. This indicates that present study reveals similar to many other studies[21]



Among the 94%, of males, 86% were riders.14% were pillion riders. Among 6% females, 67% were pillion riders 33% This reveals that 66% deaths of females were not due to their riding. Only 33% were due to their riding and other factors. But in males their own riding and factors contribute. So riders who determine the accidents which is consistent with other studies.[74] Motorcyclists are more prone for serious vulnerable road traffic accidents due to inherent instability of two wheeled vehicles[39].

Only 33% were dead due to their riding and other factors. But in males, most of them were riding of their own. This reemphasize the fact that riders especially males are more prone to fatalities due to accidents

Time of accident:



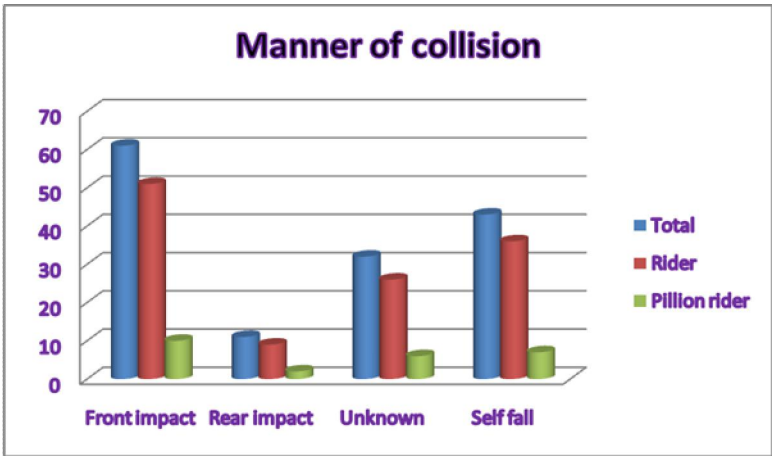
Our study reveals that the maximum proportion of accidents occur at the 2 peak hours of travel, i.e., between 6-11 AM and 6-10 PM. That too, more frequent in 6-10 PM. Among the fatalities of the interval 6-11 AM the percentage of pillion riders are significantly higher when compared to other time intervals.

In the present study, the peak occurrence of the accidents is around 6- 10 PM viz supported by many other studies.[12] Sleeplessness, fatigue and stress while returning from office contribute more to RTAs.

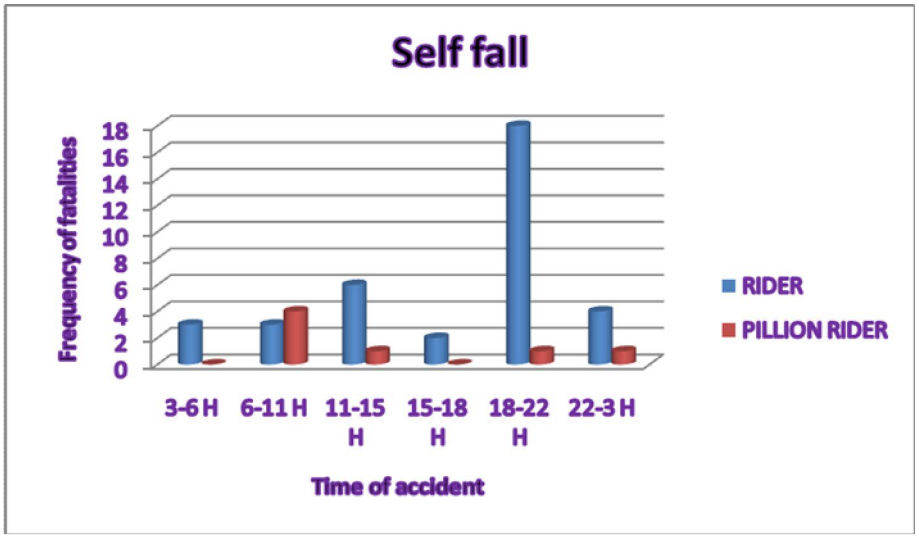
Around 29% of two wheeler accidents occur between 6.00pm-10.00. pm people return from office hours with mental stress, fatigue, driving at high speed consuming alcohol in the evening hours, invisibility of oncoming vehicles, pedestrians, animals, road medians, poor quality of roads, man holes, tress all factors contribute to occurrence of road traffic accidents. Around 11- 3 PM, is the next peak incidence this reveals that the accidents are more prone to occur during day time, contrary to the common belief. The accidents are less likely to occur between 3-6 AM because of less traffic movement.

In about 27 victims (18.36%) accident occurred 6-11am. In about 28(18.37%) victims accidents occur 11am-3 pm. 21 cases accidents occur 3-11pm (12.92%), nearly 35(23.80) accidents occur. 10pm-3.00 am 21 cases (14.28%).

Manner of Accident:

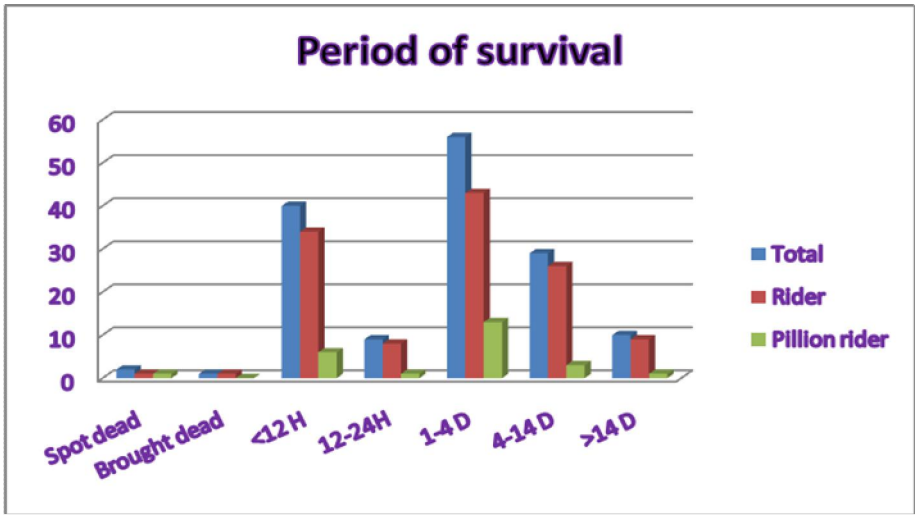


Head-on or frontal type of collisions are most common type of impact which prooves fatal, followed by self fall. The head-on collision of two vehicles can be possible when they are travelling on opposite direction[29]. This can be prevented by strict traffic regulation and by dividing the roads with median divider to make them single way roads,



The term "Self fall" is self explanatory, as it implies that the victim who is travelling in the vehicle is solely responsible for the accident and none other viz., supported by many other studies[12]. Deaths due to self fall are most frequent in time interval of 6-10 PM viz., due to various factors like dim light, fatigue, stressed up mind set carried from the work, evening hurry to home etc.

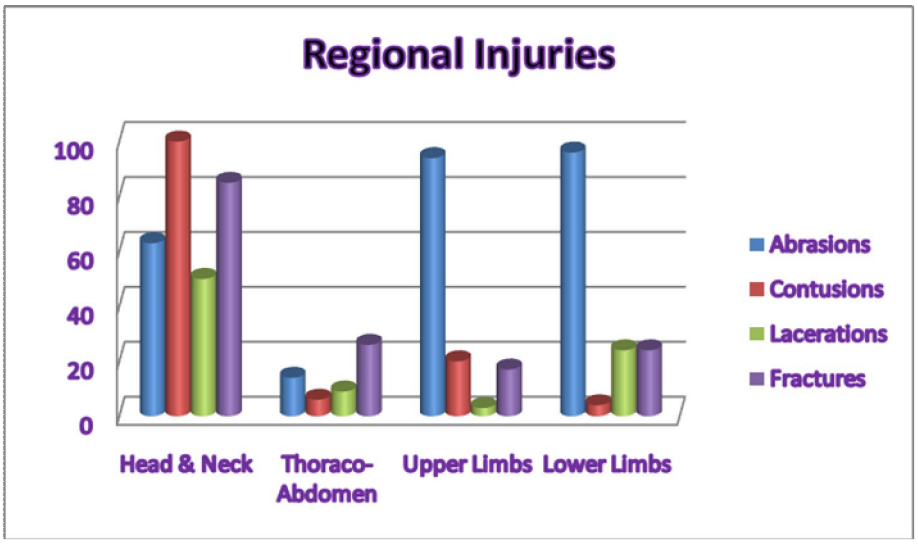
Survival period of the victims:



It is estimated that among road fatalities nearly 50-60 % occur at the site of crash or while transfer to the hospital (first wave), 20-30% during hospital stay (second wave), 5-10% after discharge from the hospital(third wave). Neurological injury, haemorrhage and shock are the major cause of death.

Regional distribution of injuries:

Majority of fatal two wheeler accident victims have received multiple external injuries. Multiple body parts were involved in each case. Abrasion, contusions, lacerations and fractures were seen over head and neck, thoraco-abdominal and extremities[33]. Multiple Injuries were more commonly observed in fatal two wheeler accidents.

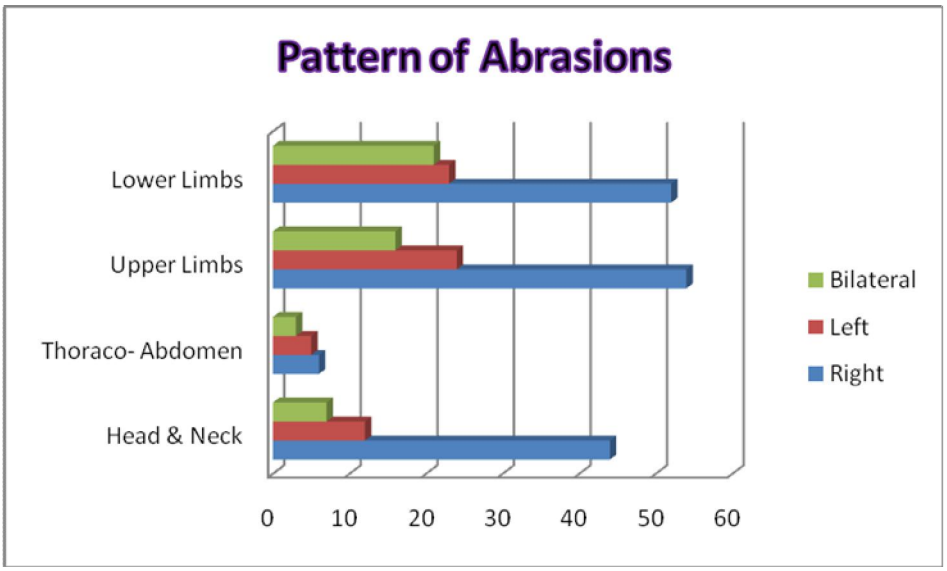


More frequency of secondary injuries seen in the motor-cyclists may be attributed to a greater distance of fall in them. Even a single crash may lead to multiple primary impacts in a victim.

Head and extremities were the most common areas to suffer superficial injuries. Crush injuries predominantly seen in lower limbs.

Distribution of Abrasions:

In our study abrasions are the most common type of injury in road traffic accidents even in all fatal cases which is also supported by many other studies[9]. It is found that abrasion injuries were more common on the extremities. In the present study, abrasions are seen more in the extremities i.e., over the upper limbs and the lower limbs, followed by the head and neck region and thoraco-abdominal regions. This correlates with the parachute reflex i.e., when a conscious individual falls there will be reflex extension of all the four limbs to protect the head and torso which contains the vital organs.



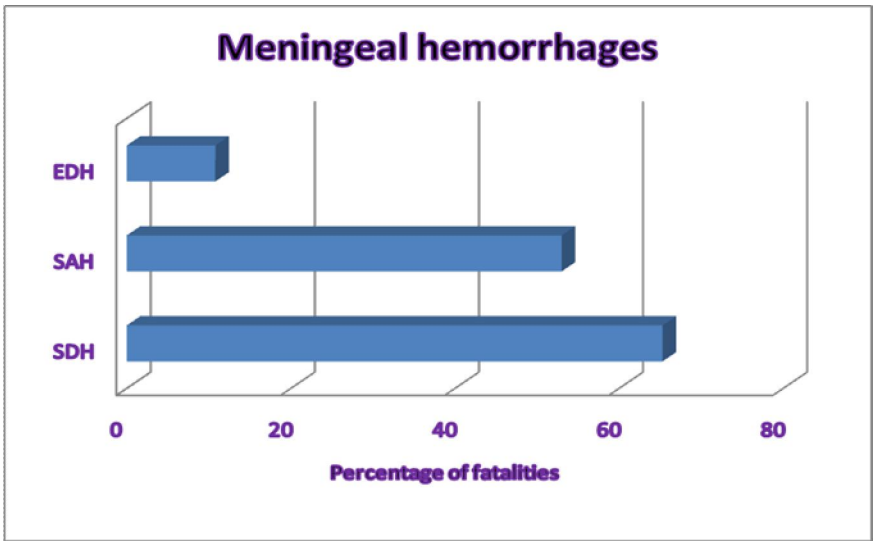
Abrasions are seen in higher frequency on the right side in all the above regions in my study. This explains that, the tendency to balance the two wheeler is more effective on the left side than the right. So incidence fall and so as the injuries are more common on the right side of the victims.

Injuries of Head and Neck:

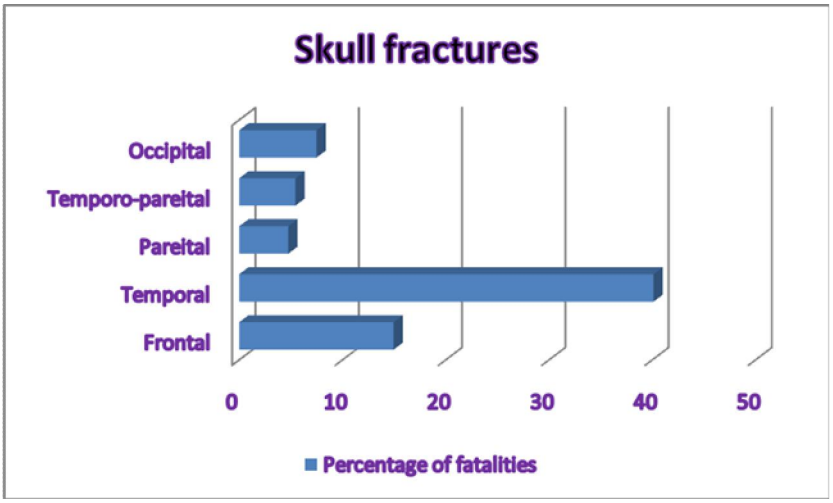
Secondary injuries are more common in motorcyclists. More frequency of secondary injuries seen in the motor-cyclists may be attributed to a greater distance of fall in them.

Even a single crash may lead to multiple primary impacts in a victim. Primary impact injuries are most commonly seen in the lower extremities and pelvis, followed by upper extremities and shoulder, whereas abdomen, head and neck are less commonly involved regions. Secondary impact injuries are mostly seen in the head and neck and are followed by upper and lower extremities. Back and abdomen are the least involved and was observed as the same in a study involved 1642 secondary injuries. Maximum injuries are recorded in lower extremities, followed by head and neck and upper

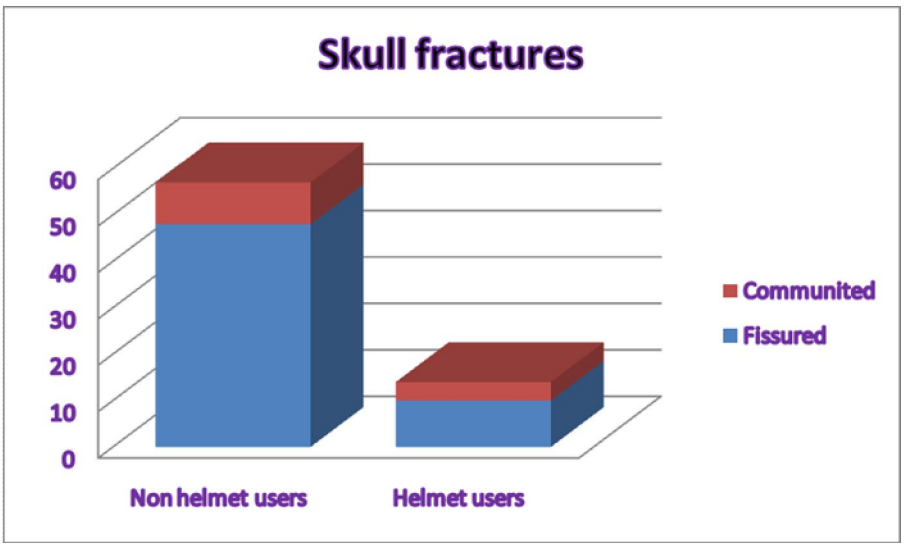
extremities. It is observed that number of secondary injuries is fairly high in fatal road traffic accidents. Crushing injuries are responsible for more incidences of secondary injuries. Contusion injuries were more common on the scalp tissue.

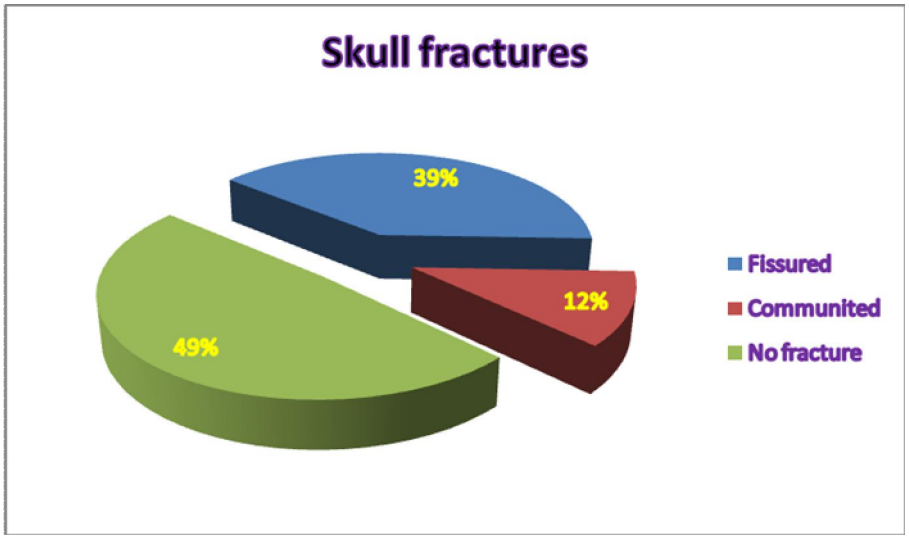


In the present study, Meningeal haemorrhages were seen in 105 cases. Riders constitute 89 whereas pillion riders 16. Subdural haemorrhages (most common) seen in 96 cases 65% of the total victims, Sub Arachnoid haemorrhages in 78 cases, 53%, Extradural haemorrhages in 16 cases, 10.8% which is supported by other studies[12].



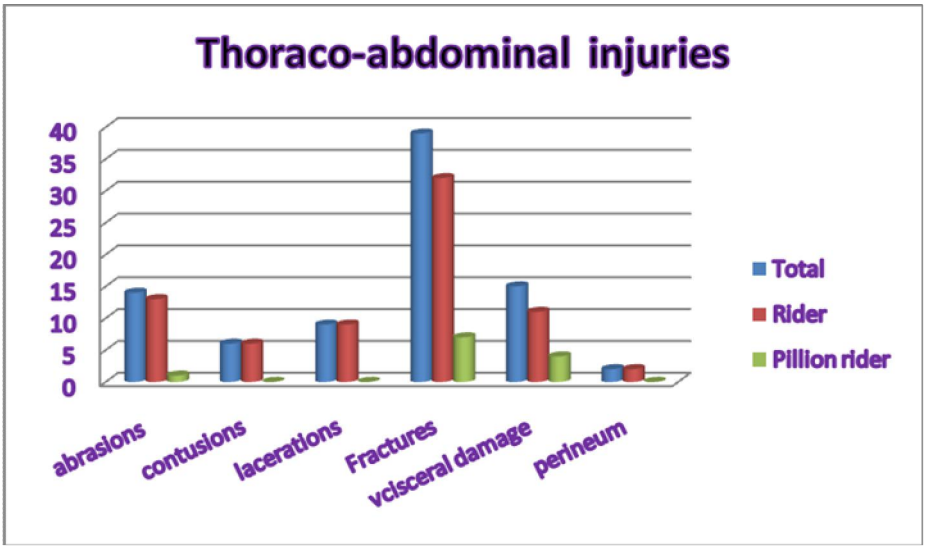
The temporal bone was found to be the most commonest vault bone to get fractured, as it is the thinnest vault bone.



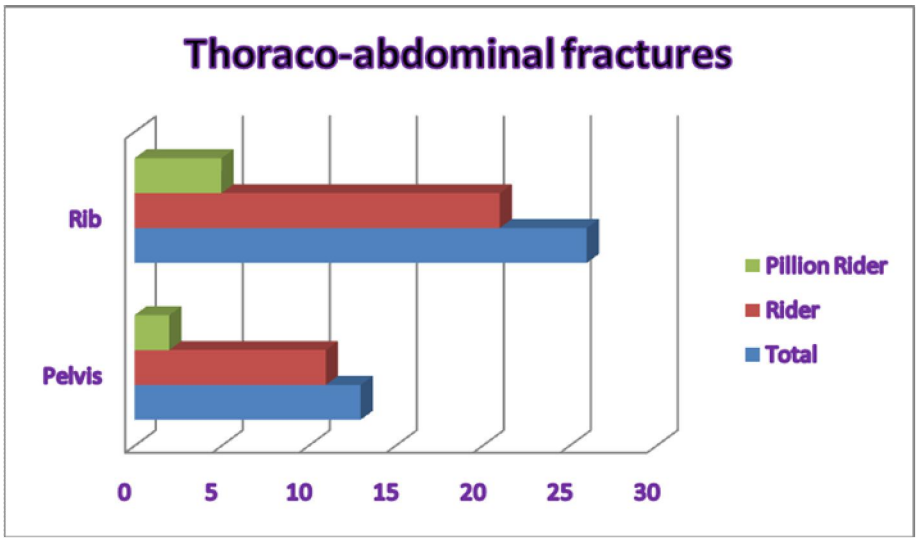


Among the skull fractures communitted fractures accounts to a significant fraction which implies the proportion of severe form of collision.

Thoraco-abdominal injuries:



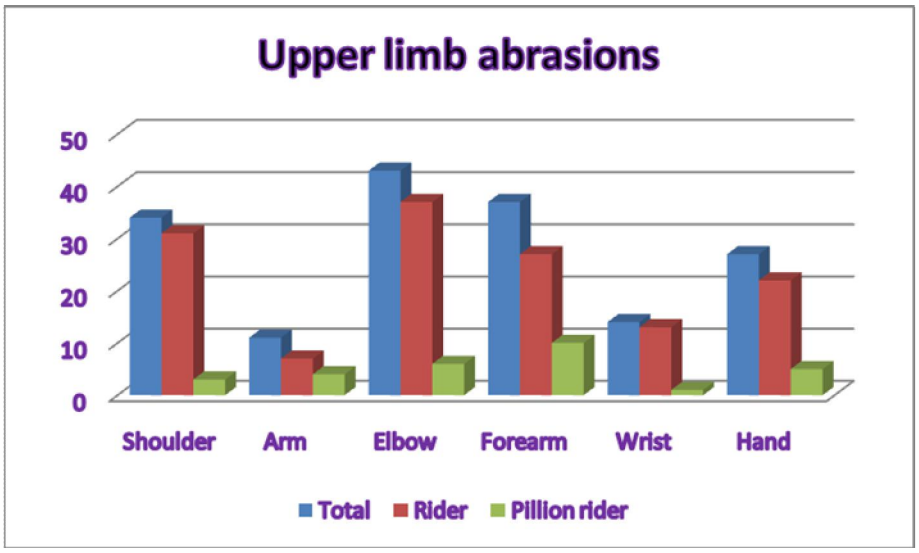
In general thorax and abdomen are safe. They are well protected by the extremities, which block any kind of harm to the trunk, if expected. Even trivial form of injury like abrasion is rare because of clothings worn by the victim. But contusions and fractures were considerable among which rib fractures and chest wall bruising were frquent. It is because the clothing can prevent trauma due to tangential forces, but not those due to perpendicular ones. The damage to the visceral organs are the most fatal.



As secondary injuries are commoner than primary injuries in thorax and abdomen there is no significant difference among riders and pillions.

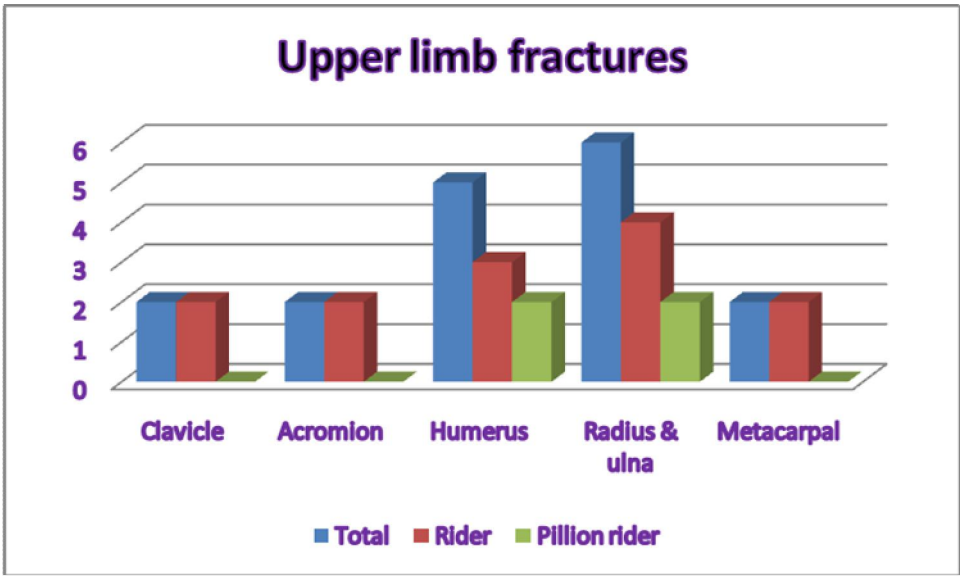
Injuries of Upper limb:

Pattern of Abrasions in Upper limbs:



The abrasions seen over the body surface are often caused due to friction over the road surface on falling over the ground.[spits] .Graze abrasions occur when the victim's body is dragged against any rough surface like roads, wall etc.[redd] or due to the fall of the motor cycle over them. Elbow and forearm are often injured in motor cycle accidents. In the present study, the abrasions in this region might have been caused by either by handle bar or fall on the ground

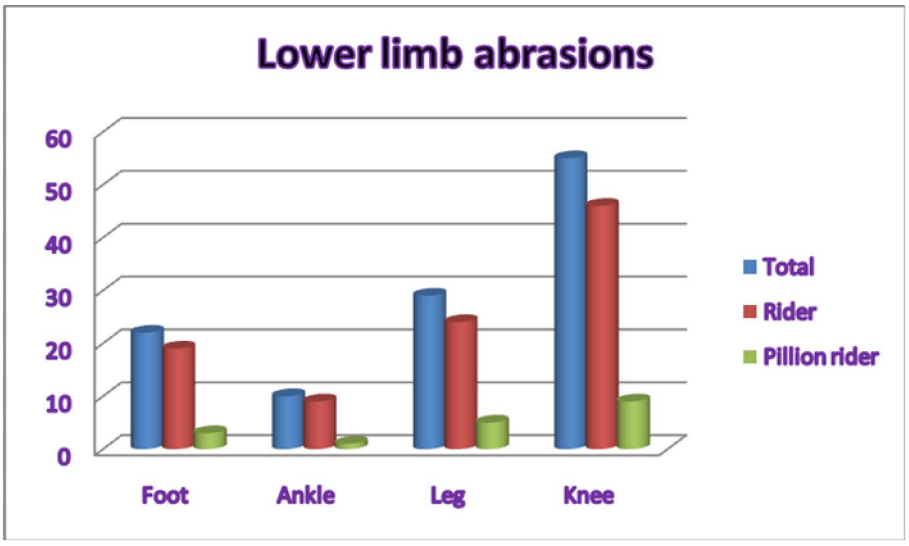
Pattern of Fractures in Upper Limbs



Injuries of Lower limbs:

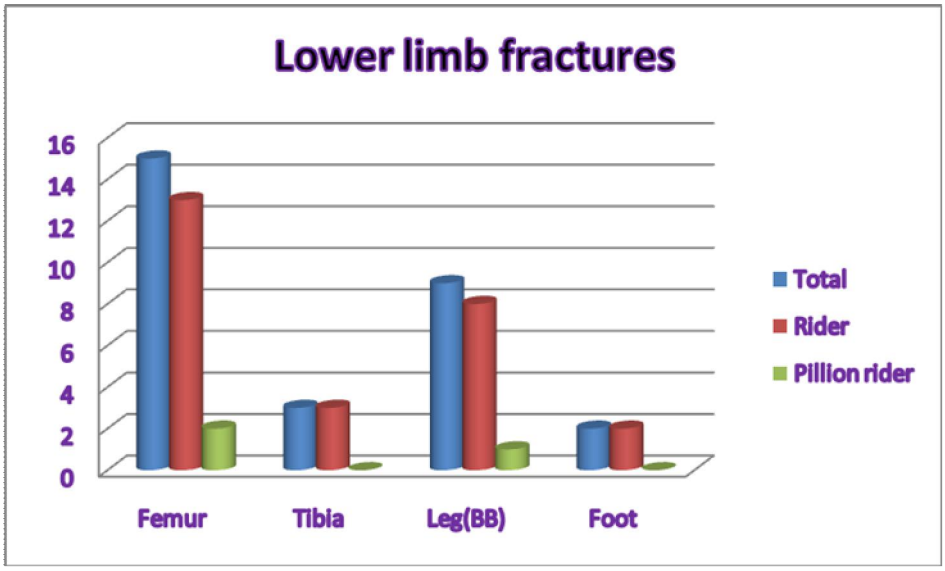
Legs are often injured in motor cycle accidents when the motorcycle dash with other vehicle or any fixed structures or the legs may be trapped in the motor cycle frame**.**

Pattern of Abrasions in Lower Limbs:



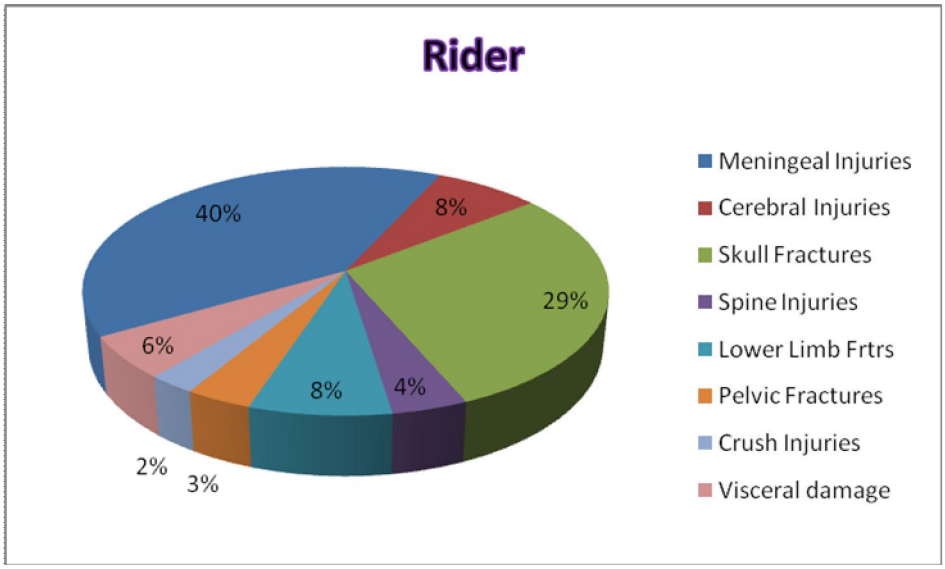
In the present study, 116 victims out of 147, had abrasions in the lower limbs. abrasions are commonly seen in the knee region irrespective of the type of ride. The highest incidence of abrasions in lower limbs both in riders and pillion riders are on the knees.

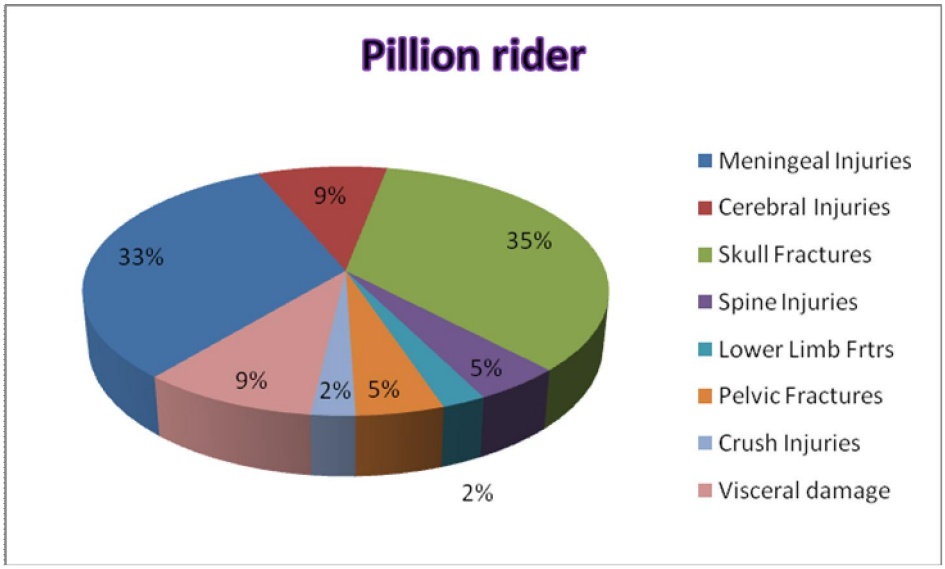
Pattern of Fractures in Lower Limbs:



In the present study, fractures were seen in 29 victims, out of which femur fracture is 15 cases (10.20%), tibia in 12 cases (8.16%). But according to most other studies, commonest fracture in lower limb occurs in tibia.[13] As we dealt with fatal cases alone and femur fracture is more fatal than that of tibia, most of the road traffic accident victims who sustained tibial fracture would have survived except few unfortunate ones, we came across.

Distribution of Fatal injuries:

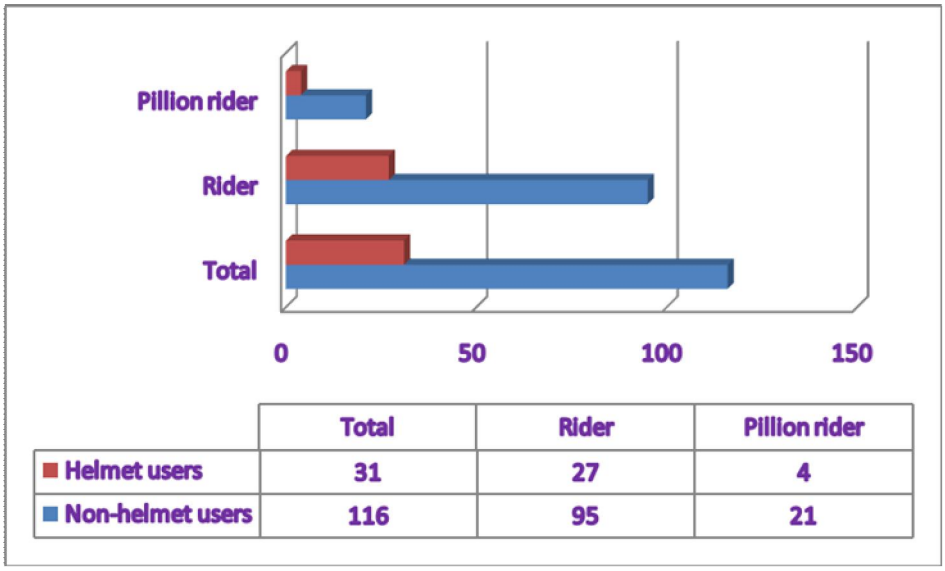




In the present study, Cranio-cerebral injuries, the commonest cause of death which is similar to other studies.[9,36] It's also noted that no significant difference in pattern of fatal head injuries among riders and pillion riders. That too Meningeal haemorrhages and cranial fractures are the most frequent fatal injuries than actual injury to the underlying brain substance.

On comparing the pattern of fatal injuries among riders and pillion riders the thoraco-abdominal injuries like visceral damage and pelvic fractures were frequent. Whereas lower limb injuries are common in riders than in pillions viz., well supported by most of the studies.[9,36]

Frequency of Helmet usage:



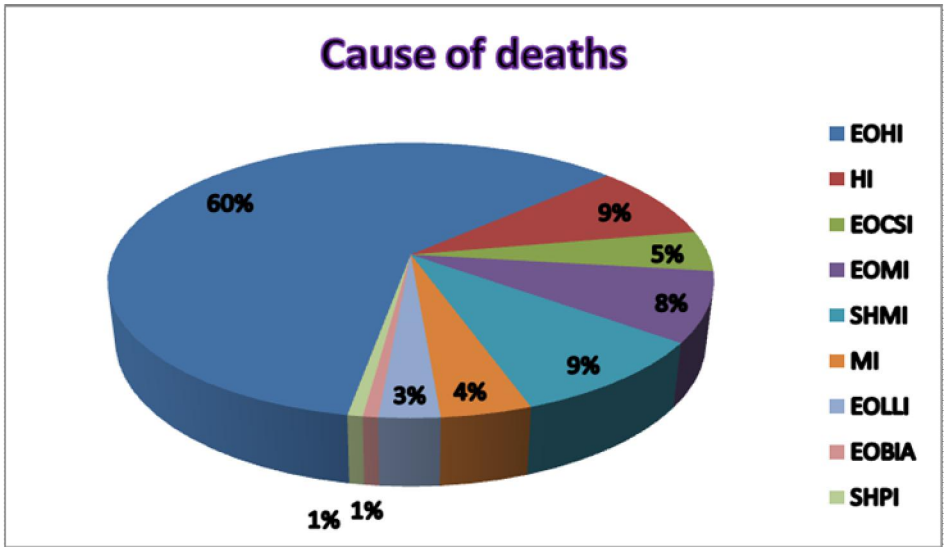
	Total	Rider	Pillion rider
Helmet users	31	27	4
Non-helmet users	116	95	21

In our study, most of the victims are non helmet users (78.9%). When compared to them, those who had worn helmet are protected from head injuries. This is reiterated by the findings that the head injury remains to be the most common cause of death among non helmet users.57.5% of non helmet users died of head injuries, whereas only 11.56% of helmet users died of head injuries. Helmet users were comparatively protected from cranial injuries but not from spinal injuries. However, the major cause of death among helmet users was shock and hemorrhage due to skeletal injuries and visceral injuries.

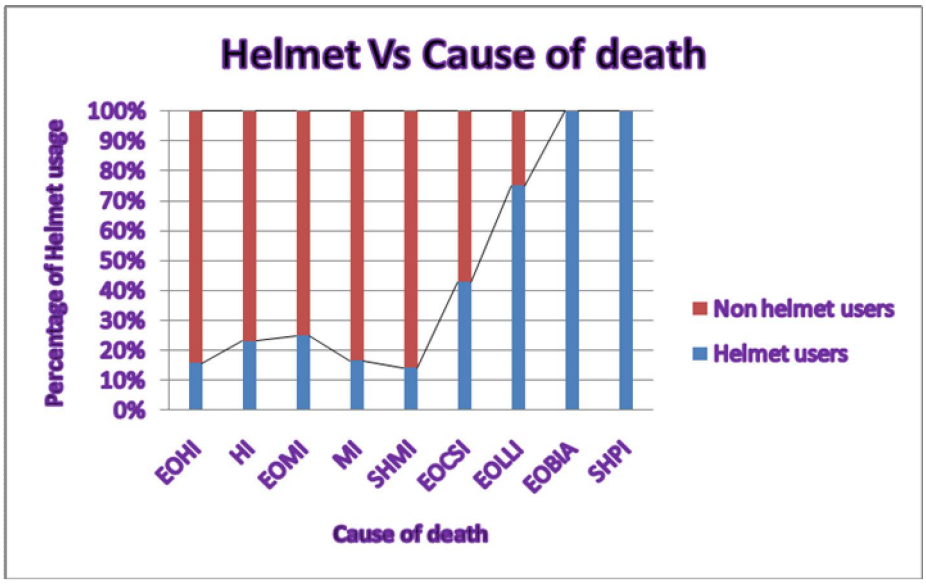
	Male	Female	Total
Without Helmet	108	8	116
With Helmet	30	1	31

Among the females percentage of helmet usage is far less when compare to males because, most of the female victims are pillions and they usually avoid or denied helmets.

Cause of death:



Among the RTA victims, cranio-cerebral injuries remains to be the most common killer(69%). Unfortunately, 57.5% victims were non helmet users. The second common cause of death was due to multiple injuries. Lower limb injuries and abdominal visceral injuries were the lowest fatal injuries among our sample.



Among the total death toll due to head injuries percentage of helmet users were significantly low (20%), when compared to non helmet users who were about 80% as in many other studies[12]. But, in death due to other causes helmet provides no protection at all. More over from the history collected in our study depicts that, most of the helmet users died in high energy collisions involving heavy and light weight motor vehicles. In contrast non helmet users succumbed to even relatively less energy accidents like self fall.

CONCLUSION

Among 1160 road traffic fatalities received from Jan-2011 to Nov-2011in our institution about 350 cases were victims of two wheeler accidents. Out of which 147 fatalities were studied and the following conclusions are drawn:

1) Majority of the victims were males and especially riders.

2) Most of the victims belong to the age group 20-30 years.

3) Most of the accidents occurred around 6 PM- 10 PM.

4) Majority of accidents were frontal collisions.

5) Self fall accounts for a significant proportion of the total burden of two wheeler accidents, that too mostly around 6-10 PM.

6) When compared with the time interval and number of fatalities, too many deaths occurred within 12 hrs of the accident.

7) All types of injuries were highly frequent in head and neck region followed by extremities.

8) Most of the injuries occurred on the right side of the victim’s bodies.

9) Among head injuries Meningeal haemorrhages ranks first, followed by scalp contusions and skull fractures.

10) Subdural haemorrhages were commonest among meningeal haemorrhages and temporal bone suffers most fractures sharing with middle cranial fossa.

11) Among the abrasions on upper limb elbow and forearm suffers the most. Fractures are also most frequent in the bones of forearm followed by humerus.

12) In case of lower limbs, knee was abraded the most. Femur was broken most frequently followed by tibia.

13) Though meningeal haemorrhages are the major fraction of all fatal injuries, among the fractures, the commonest was the skull fractures (49.6%). Followed by lower limbs, upper limbs, ribs, pelvic fractures.

14) Vast majority of the road users were not wearing helmets and so the major cause of death in case of their fatalities are “Head Injuries”. Skull fractures were most frequent in non helmet users

15) Cause of death other than head injuries are more frequent in helmet users. Manner of accident is also more severe in fatalities of helmet users.

Other than these huge death toll to road traffic accidents, it is also estimated that, the economic loss due to the total road traffic accidents in India accounts for about 2% of its gross domestic product. In the last decade the total road traffic fatalities were almost equal in both India and European countries. But, the later understood the severity of the situation and revised their road safety policies and by implementing various safety measures, they reduce the fatalities by about 50%. But India witnessed a raise of about 50% in road traffic fatalities, increasing the mortality risk by 5 folds on the roads than elsewhere.

As the economic growth along with the vehicular population, overrides the speed of advancement of the safety measures, it is almost not possible to

reduce the road traffic fatalities. So, we are in a crucial moment to proove our immediate intervention to improve the quality of road infrastructure, technology of vehicular safety and their quality, ease of accessibility of immediate medical care by redefining our health policies and legislation.

RECOMMENDATIONS

Need for road safety policies:

Road safety policy is nothing but the statement of various steps to be undertaken to achieve the visualized targets, set in this field to tackle identified safety issues. Road traffic accidents are preventable. Significant number of road traffic fatalities and injuries are not a fundamental law of nature or inevitable result of motorization .Other countries have been successful in improving their road safety by adopting road safety action plans. Adoption of the appropriate road safety policy was the main driving force essentially needed for the major reduction in road traffic fatalities in those countries.

The first three policies among the 11- elements for road safety policies under the vision Safer Roads For Everyone includes

1. Raising awareness about road safety issues among decision makers, citizens and road users. 2. Provision of Legislature, Institutional and Financial base for road safety. 3. Development of road safety information database. Other elements include road infrastructure, vehicles, drivers, road safety education and training. These policy statements adopted as National Road Safety Policy which serve as guidelines for road safety planning and programming at National, State and Local levels. In India, The National Road Safety council (NRSC) is under the chairmanship of the Minister in-charge of Road transport and Highways at the centre is an overall high level advisory body.

We, citizens of India must prevent the Road Traffic Accidents to rank third place in the year 2020.

RTA must be considered like other notifiable diseases. Reports should be collected from the primary health centre level to Tertiary hospitals level on a weekly basis.Road Safety Campaigns should be frequently conducted. Police Officials must seriously enforce the laws considering the road safety.Fine on those persons not wearing helmet, more than two persons travelling per bike, persons using cell phones while riding, those who ride at excessive speed , testing for alcohol etc. Transport Authorities must take measures to laid down new roads, improve the quality of old roads, sufficient road , ensure if signals working properly in all places etc. Illumination must be sufficient for riding during the night time, higher number of traffic police for guiding and enforcing the rules and regulations since more number of accidents occur during the night time. Measures to prevent pedestrians and animal interventions in the traffic. All State governments must ensure the accessibility and availability of Emergency Trauma Care, increasing the Ambulance services, sufficient number of doctors at all specialities, appropriate emergency medical care etc. Education regarding the traffic rules should be a separate curriculum. We must all join together to bring down, eliminate and eradicate the road traffic accidents by 2020.

BIBLIOGRAPHY

1. Two-wheelers on Indian roads: how safe are they?– August 25, 2011Posted in: Articles, Automotive & Trucks, Roads & Highways

2. "All the info you need on lanesharing (lanesplitting)". www.WhyBike.com.http://www.whybike.com/motorcycle274.htm.Retrieved 28 June 2007. 20 Anna Maria Kalli, Elias AissarSallum, Cristiane de AlencarDomingue

3. Douglas Bowley ,Kenneth Boffard Pattern of injury in motor vehicle accidents Pattern of injury in motor vehicle accidents.

4. World Report On Road Traffic Injury Prevention –WHO Geneva 2004

5. NHTSA: Motorcycles Traffic Safety Fact Sheet (DOT-HS-1200 New Jersey Avenue SE., Washington, DC 20590:810-990)

6. "Motorcyclists - Crashes". Australian Transport "Motorcyclists - Crashes". AustralianTransport Safety Bureau(ATS).2005 http://www.transport.sa.gov.au/rss/content/safer_people/road_users/motorcyclists_crashes.htmrt Safety Bureau (ATS)

7. Harry Hurt,University of Southern California,Grease and Gasoline,30 Nov 2011 cause of preventable injury

8. Motorcycle Accident Cause Factors and Identification of Countermeasures, Volume 1: Technical Report, Hurt, H.H., Ouellet, J.V. and Thom, D.R., Traffic Safety Center, University of Southern California, Los Angeles, California 90007, Contract No. DOT HS-5-01160

9. NilambarJha, DK Srinivasa, Gautam Roy, S JagdishYear: 2003 Volume : 28 Issue : 2 Page : 85 Injury Pattern among Road Traffic Accident Cases

10. Zeng Hao Wong, [1]MBBS, Chee Keong Chong, 2MBBS, FRCS (Edin) FRCS (Glas), Bee Choo Tai, [3]Msc, PhD, Gilbert Lau, [4]FAMS, MRCPath DMJ (Path).Review of fatal road traffic accidents from Singapore from 2000 to 2004. Annals Academy of Medicine.2009.38:594-9

11. Jain A, Menezes RG, Kanchan T, Gagan S, Jain R. Two wheeler accidents on Indian roads--a study from Mangalore, India. J Forensic Leg Med. 2009 Apr; 16(3):130-3. Epub 2008 Oct 22.

12. Michael Fitzharris[1,2,3],Rakhi Dandona[*1,4,5], G.Anil Kumar[4,5] and Lalit Dandona[1,4,5] Crash characteristics and patters of injury among hospitalized motorized two-wheeled vehicle users in urban India. BMC Public Health 2009, 9:11doi: 10.1186/1471-2458-9-

13. Kortor JN, Yinusa W, Ugbeye ME. Lower limb injuries arising from motorcycle crashes. Niger J Med. 2010 Oct-Dec; 19(4):475-8. rt Safety Bureau (ATS

14. Menon A , Pai VK and Rajeev A . Pattern of fatal head injuries due to vehicular accidents in Mangalore. J Forensic Leg Med. 2008; 15(2): 75-7.

15. Zargar M, Khaji A. Karbakhsh M. Pattern of motor cycle related injuries in Tehran. 1999 to 2000: a study in 6 hospitals. East Mediterranian Health J. 2006 Jan- Mar: 12 (1-2):81-7

16. Dischinger PC, Ryb GE, Ho SM, Braver ER. Injury patters and severity among hospitalized motorcyclists: a comparison of younger and older riders. Annu Proc Assoc Adv Automot Med 2006;50:226-38.

17. David Dolinak, Evan Matshes,Emma Lew ,– Text book of forensic pathology-principles and practice 2005-ch 11 page no 259 Motor vehicle collisions.

18. Martin JL, Lafont S, Chiron M, Gadegbeku B, Laumon B Differences between males and females in traffic accident risk in France, Rev EpidemiolSantePublique. 2004 Sep; 52(4):357-67.

19. Oginni FO, Ajike SO, Obuekwe ON, Fasola O. A prospective multicenter study of injury profile, severity and risk factors in 221 motorcycle-injured Nigerian maxillofacial patients.. Traffic Injury Prev. 2009; 10(1): 70-75. Trauma 14:187-196;1974

20. Valent F, Di Bartolomeo S, Marchetti R, Sbrojavacca R, Barbone F. A case-crossover study of sleep and work hours and the risk of road traffic accidents. Sleep. 2010 Mar; 33(3):349-54

21. Cherpitel CJ. Alcohol and injuries: a review of international Emergency room studies. Addiction 1993; 88: 923-37.

22. Cherpitel CJ, Bond J. Ye Yu, et al. A cross-national meta-analysis of alcohol and injury: data from the emergency room collaborative alcohol analysis project (ERCAAP) (2003). Society for the study of addiction to alcohol and other drugs. Addiction 2003; 98: 1277-86.

23. G. Gururaj ROAD TRAFFIC INJURIES ALCOHOL AND ROAD TRAFFIC INJURIES IN SOUTHASIA: CHALLENGES FOR PREVENTION JCPSP 2004 Vol. 14 (12): 1-2

24. R.R.Tiwari, G.B. Ganveer. A study on human risk factors in non-fatal road traffic accidents at Nagpur.Indian Journal of Public Health Vol. 52 No 4 October-December, 2008 197-8.

25. Hui Zhao, Rong Chen, Guijing Deng, Zhiyong Yin, Guangyu Yang, Shengxiong Liu, Huipeng Chen, Zhengguo Wang. Comparison of injuries sustained by drivers and pillion passengers in fatal head-on motorcycle collision accidents. Forensic science international (impact factor: 2.1). 10/2010; DOI: 10.1016 j.forsciint.2010.10.0033

26. Anish Sam George, Murali Poduval, Analysis of Limb Injury Patterns in Victims of Two Wheeler Accidents. Asian Journal of Medical Sciences Vol.1 (1) 2010 p.14-15

27. R Dandona,G A kumar T.S Raj ,and L Dandona patterns of road traffic injuries in a vulnerable population in Hyderabad,India.Injury prevention 2006 June;12 (3):183-188.

28. Zargar M, Khaji A. Karbakhsh M. Pattern of motor cycle related injuries in Tehran. 1999 to 2000: a study in 6 hospitals. East Mediterr Health J. 2006 Jan- Mar: 12 (1-2):81-7

29. Peek-Asa C, Kraus JF, Injuries sustained by motorcycle riders in the approaching turn crash configuration, Acc. Anal. and Prev., 28(5), 561-9, 1996

30. Dandona R, Kumar GA, Dandona L. Risky behaviour of drivers of motorized two wheeled vehicles in India. J Safety Res. 2006; 37(2):149-58. Epub 2006 May

31. Javouhey E, Guerin AC & Chiron M. Incidence and risk factors of severe traumatic brain injury resulting from road accidents: A population-based study. Accident Analysis and Prevention. 2006. 38: 225-233.

32. de Oliveira NL, de Sousa RM (Rev Lat Am Enfermagem. 2011 Apr; 19(2):419(2):403

33. Susan Wells et al. (April 10, 2004). "Motorcycle rider conspicuity and crash related injury: case-control study". BMJ. http://www.bmj.com/cgi/content/full/328/7444/857. Retrieved 2007-06-26. Abstract, Quick summary

34. Redelmeier DA, Tibsh irani RJ. and Dr. S.S. Oberoi, Dr. K.K. Aggarwal, Dr. D.S. Bhullar, Dr.R. Kumar, PATTERN AND DISTRIBUTION OF INJURIES IN FATAL TWO WHEELER AC CIDENTAL CASES. Journal of Punjab Academy of Forensic Medicine & Toxicology 10 (2010)

35. Baker SP et al, "The Injury Severity Score: a method for describing patients with multiple injuries and evaluating the severity of injuries

36. Dr. S.S. Oberoi, Dr. K.K. Aggarwal, Dr. D.S. Bhullar, Dr.R. Kumar, PATTERN AND DISTRIBUTION OF INJURIES IN FATAL TWO WHEELER ACCIDENTAL CASES. Journal of Punjab Academy of Forensic Medicine & Toxicology 10 (2010). C Haasper; D Otte; K

Knobloch; J Zeichen; C Krettek; M Richter. Knee injuries of vulnerable road users in road traffic. Der Unfallchirurg 2006; 109(12):1025-31.

37. H Markogiannakis, E Sanidas, E Messaris, D Koutentakis, K Alpantaki, AKafetzakis, D Tsiftsis. Motor vehicle trauma: analysis of injury profiles by road-user category. Emerg Med J 2006; 23:27-31. Doi: 10.1136/ emj.2004. 022392.

38. Werner U.SPITZ Ch 17, Road Traffic Victims.

39. Fatal road traffic accidents and their relationship with head injuries , 2008. 63. Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years. Arvind Kumar MD, Sanjeev Lalwani MD, http://www.ijntonline.com/ Dec08/abstracts/abs2.PDF

40. Dr KSN Narayana Reddy, Dr KSN Narayana Reddy, the essential of Forensic Medicine and Toxicology, 30th Edition 2011 Ch-6 p163

41. Akhilesh Pathak, N. L Desania and Rajesh Verma. Profile of road traffic accidents and Head Injury in Jaipur (Rajasthan).J. Indian Acad Forensic Med, 30(1).

42. Aslam M, Taj TM, Ali SA, Mirza WA, Badar N. Non-fatal limb injuries in motorbike accidents. J Coll Physicians Surg Pak. 2008 Oct; 18(10):635-8

43. Calil AM, Sallum EA, Domingues CA, Nogueira LS. Mapping injuries in traffic accidents victims: a literature review. Rev Latino-am Enfermagem 2009 janeiro-fevereiro; 17(1):120-125.

44. Lateef F, Riding motorcycles: is it a lower limb hazard? Singapore Med J. 2002 Nov; 43(11):566-9.

45. Singh YN, Bairagi KK & Das KC. An epidemiological study of road traffic accident victims in medicolegal autopsies. J Indian Acad Forensic Med. 2005; 27(3): 166-69

46. E.Th.Petridou , E.Germeni , A .Ntinapogias ,The European Code Against Injuries(ECAI) , Archives of Helenic Medicine, vol 25, supplement 1, 2008.

47. Australian Institute of Family Studies, TAC & RAVCV, ATP Young Drivers Study2002.

INSTITUTIONAL ETHICS COMMITTEE
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CERTIFICATE OF APPROVAL

To
Dr. M. Seethalakshmi
PG in MD forensic Medicine
Madras Medical College , Ch-3

Dear Dr. M. Seethalakshmi

The Institutional Ethics Committee of Madras Medical College reviewed and discussed your application for approval of the proposal entitled " Study of injury pattern in road traffic accidents involving two wheelers" No. 27012011.

The following members of Ethics Committee were present in the meeting held on 28.01.2011 conducted at Madras Medical College, Chennai -3.

1. Prof. S.K. Rajan, MD	– Chairperson
2. Prof. A. Sundaram, MD Dean i/c , Madras Medical College, Chennai -3	– Member Secretary
3. Prof R. Sathianathan Director , Institute of Psychiatry, MMC,Ch-3	– Member
4. Prof R. Nandhini, MD Director, Institute of Pharmacology, MMC, Ch-3	– Member
5. Prof. Geetha Subramanian, MD,DM Prof. & Head , Dept. of Cardiology, MMC, Ch-3	– Member
6. Prof. Md. Ali, MD, DM Professor & Head ,,Dept. of MGE, MMC, Ch-3	– Member
7. Thiru. T.S. Bharathidasan Administrative Officer, MMC, Chennai -3	– Layperson
8. Thiru. S. Govindasamy . BA.BL	– Lawyer
9. Tmt. Arnold Soulina	– Social Scientist

We approve the Proposal to be conducted in its presented form.

Sd /. Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information / informed consent and asks to be provided a copy of the final report

Member Secretary, Ethics Committee

ABSTRACT

AIM: This study was done to observe and analyze the pattern of injuries among victims of two wheeler accidents, influence of Physical factors, the survival period of victims and the effectiveness of helmets in providing protection.

MATERIALS AND METHODS: It is a prospective study involving 147 two wheeler road traffic accidents victims brought to the Institute of Forensic Medicine for Medicolegal examination. Preliminary datas collected from the investigating Officer and the injuries measured during autopsy were entered in the Excel Sheet. Statistical Analysis done using SSPS Software version 16.

RESULTS: Majority of the Victims were males belonging to the age group of 20- 40 years. Riders were most commonly involved than Pillion riders. Significant proportion of the riders were males. Most of the accidents occur about 6.00 p.m to 10.00 p.m. The number of victims died per hour was higher first 12 hours. Injury pattern was analysed. Abrasions were higher in frequency among the external injuries, seen more in the extremities. Among the head injuries contusions are commonly seen followed by fractures. Most commonly involved skull bone is temporal bone, linear fissure fracture type more in frequency than communited fracture. Subdural haemorrhage seen in higher

frequency. In riders, Fracture of Forearm bones, Femur commonly involved. No significant difference in the cause of death among the riders and pillion riders. Head injury is commonest cause of death. Among the non helmet uses, head injury is the most common cause of death.

CONCLUSION: The Present study shows that the mostly commonly involved victims are males, age group 20 to 40 years. Most of them are riders. Self fall is commonly seen around 6.00 p.m to 10.00 p.m. Cranio Cerebral injuries are the commonest cause of death, more among the non helmet users. Helmet wearing plays one of the most important factors preventing the fatality.